B3075-1-U

1987 — 2001
OUTLOOK FOR COMMERCIAL AIRCRAFT

SEPTEMBER 1987

MCDONNELL DOUGLAS

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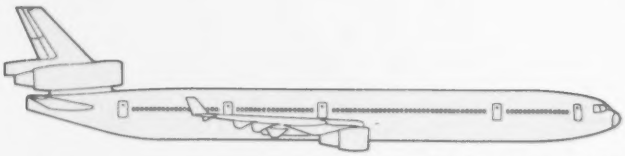
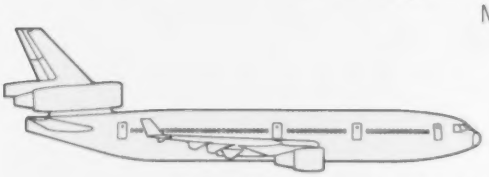
COMMERCIAL FAMILY TO THE 21st CENTURY



MD-11 STRETCH



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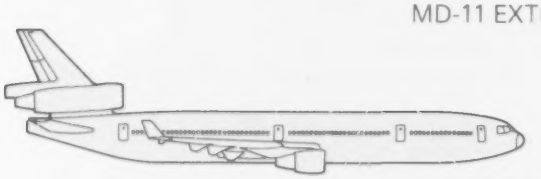

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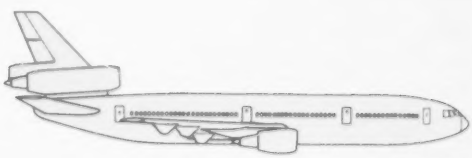
- ALL-PASSENGER VERSION
- COMBI VERSION
- FREIGHTER VERSION



DC-10-30
- ALL-PASSENGER VERSION
- FREIGHTER VERSION

MD-92

MD-91

MD-87

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INTRODUCTION

INTRODUCTION

This report presents the results of the McDonnell Douglas forecast of the world's commercial aircraft requirements over the next 15 years. The *Outlook for Commercial Aircraft* is produced and published annually by the Douglas Aircraft Company, a component of the McDonnell Douglas Corporation.

This study is organized by initially providing a brief synopsis of the forecast findings. An overview of the world's economy follows with forecasts of the primary economic variables affecting both passenger and cargo traffic developments. Then an analysis of the passenger aircraft market is presented with traffic forecasts, fleet planning assumptions, and projected aircraft requirements through the year 2001. A similar review of the cargo market is also provided with traffic projections and forecasts of freighter fleet requirements.

Any comments or questions regarding the contents of this publication may be addressed to Strategic Analysis (18-70), Douglas Aircraft Company, 3855 Lakewood Boulevard, Long Beach, California 90846, U.S.A.

FORECAST SYNOPSIS

FORECAST SYNOPSIS

The air transportation industry has experienced marked structural changes as it has evolved over the past decade. The Airline Deregulation Act of 1978 in the United States can be considered the catalyst in commercial aviation's new "free market" restructuring. However, few industry observers envisioned the tumultuous impact this Federal mandate would bear. Today, after a proliferation of new carriers, routes, and bankruptcies, consolidation is the byword for strength and competitiveness in the United States, resulting in the formation of "mega-carriers."

As U.S. aviation policy is "exported" to other continents, a less regulated atmosphere will encompass the aviation industry. A more limited form of restructuring will develop in other regions, with joint operations and consolidations resulting as carriers respond to competitive pressures. A significant part of this future will be a growth-conducive economic environment, averaging 3 percent worldwide over the next decade. Real passenger yields will provide a further impetus by continuing to decline, although at a decelerated rate.

PASSENGER MARKET

Passenger carriers experienced a wide range of unprecedented challenges during 1986, spanning from rapid traffic declines blamed on terrorism and the Chernobyl nuclear disaster to a rash of airline mergers in the U.S. In spite of these events, worldwide passenger traffic posted a respectable 5.5-percent improvement in 1986. Carriers are continuing to posture themselves for the heightened competitive battles foreseen ahead.

With a generally positive outlook expected for the world economy, passenger traffic is forecasted to develop at 6.4 percent annually through 2001. Asian routes will demonstrate the most significant progress reflecting Asia's continued economic advancement. Consequently, Asian domiciled airlines are anticipated to grow by 8.6 percent per year in traffic carried, thus showing excellent prospects for expanded fleets. U.S. and European-based carriers, however, will demonstrate a more subdued development, both averaging only 5.7 percent annual traffic gains over the time frame.

The generic demand for new passenger aircraft (excluding aircraft on order at year-end 1986) is forecasted at 5,687 units through 2001, with a value totalling $278 billion (constant 1987 dollars). In terms of generic classes, this forecast is segmented as follows: 1,201 aircraft for the Short Range-110 class; 1,641 for the Short Range-160; 905 for the Medium/Long Range-200; 694 Medium Range-270; 366 Long Range-270; 211 Medium Range-400/600; 516 Long Range-400; and 153 aircraft in the Long Range-600 class. While short-range classes compose one-half of the unit demand, the medium- and long-range classes will provide more significant relative growth. These estimates have assumed a conservative retirement schedule of aircraft currently in service as well as an ascending average load factor gradually reaching 70 percent.

U.S. carriers will encompass 42 percent of this 15-year total. The remaining demand of 58 percent will be roughly divided equally among airlines based in Europe, Pacific/Asia, and the rest of the world. Pacific and Asia carrier demands, however, will be more concentrated in the larger generic classes than other non-U.S. domiciled airlines. Timing for the required aircraft will peak during the 1992 through 1996 period when 45 percent of the total units will be needed.

In conclusion, the worldwide passenger aircraft fleet will expand by 67 percent from its existing level to over 10,300 units by the year 2001. To accommodate this expansion as well as provide for the replacement of 2,500 units estimated to be permanently retired, nearly 6,700 aircraft will be required. While approximately 1,000 of these are already on order, the remaining 5,687 generic aircraft will present considerable opportunities for the world's airframe manufacturers.

CARGO MARKET

Airline deregulation in the U.S. caused significant structural changes to the worldwide air cargo industry during the first half of the 1980s. However, these changes moderated in 1986 resulting in a year of stability and healthy growth. World air cargo produced a gain approaching 8 percent, paced by the dynamic small express package segment. The integrated operators who compose this sector continue to demonstrate significant growth. As a means of further stimulating development, these carriers are turning their sights to intercontinental markets for expansion. A variety of tactics will be employed to achieve international expansion including new route applications, consolidations, mergers, joint ventures, and takeovers. The eventual outcome could result in the survival of only the strongest integrated operators.

Total worldwide air cargo is forecast to develop at an average of 6.5 percent through 2001. Asian markets will represent the primary focus for air cargo development by averaging 8.5 percent. As specialized air cargo services become increasingly important to shippers, goods transported on pure freighters should grow at a faster rate than those carried on passenger flights. This should, therefore, intensify competition among cargo carriers and stimulate demand for freighters.

By 2001, the world's active freighter fleet is projected to number 698 in contrast to the 375 units in operation at the end of 1986. After considering a conservative retirement schedule for freighters currently in service, an additional 406 aircraft will be required over the time frame. Of these, 132 units will be derived from the large freighter class, 109 will be from the medium generic category, and 165 will be small freighters. This requirement is expected to be obtained from a combination of newly manufactured freighters and used passenger aircraft conversions.

ECONOMIC OVERVIEW

ECONOMIC OVERVIEW

CURRENT ENVIRONMENT

World economic growth, adjusted for inflation, increased 2.5 percent in 1986, the fourth consecutive year of economic expansion. Although this growth was less than the 3.1 percent recorded in 1985 and 4.5 percent in 1984, it was achieved in an environment of lower inflation. Economic growth is forecast to drop further in 1987 due to lower trade and weak demand, but rebound in 1988.

World inflation last year is estimated to have reached only 10 percent. This rate is down considerably from the 30 percent that prevailed in 1985 and represents the lowest inflation since 1973. The decline in world inflation can be traced to three factors. First, oil prices declined sharply as Saudi Arabia increased output. Second, commodity prices in general fell in response to weak demand and long-term trends. And third, Latin American inflation dropped from over 300 percent in 1985 to under 90 percent last year due to major improvements in Brazil and Argentina. Inflation in 1987 is expected to fall only fractionally since price moderation in Latin America, Europe, and Africa will be largely offset by expected higher inflation in North America, Asia, and the Middle East. Over the next decade, world inflation should average about 9 percent annually.

Most of the slowdown in economic growth during 1986 originated in North America and the Pacific/Asia, resulting from reduced trade growth and weaker consumer demand. African economic growth was negative due to its high external debt, forcing governments to adopt restrictive economic policies. The Middle East suffered its second year of negative growth as oil revenues declined again. In Europe, 1986 was almost a replay of 1985 in most countries. Latin America was the only region whose growth was higher in 1986 than in 1985 (5.3 versus 3.0 percent). Latin American efforts to expand exports in order to service its high external debt were largely responsible for this improvement. The U.S. "growth pause" in 1987 will cause economic development to be lower in all world regions except Africa and the Middle East, where growth should be flat.

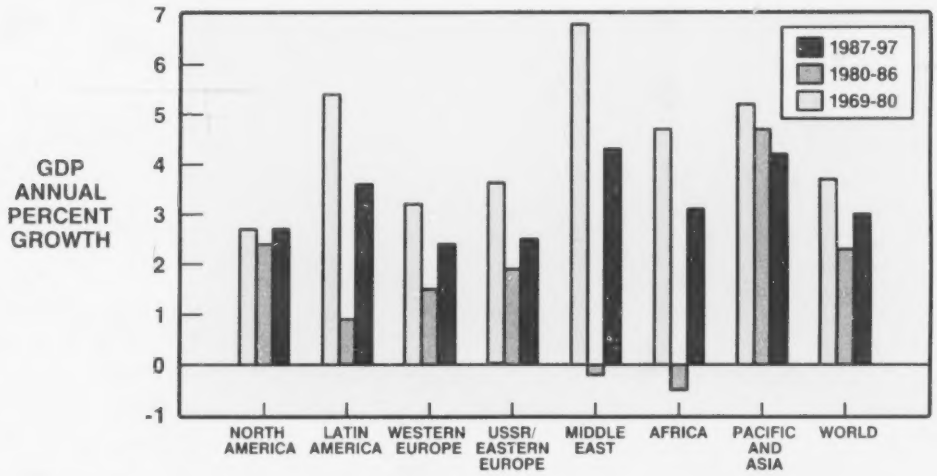
LONG-TERM ECONOMIC GROWTH

The past 17-year period marks two widely different trends. The first period (1969-1980) was characterized by significantly higher economic performance than the second (1980-86) in most regions as the accompanying charts shows. The only exceptions to this generalization were North America, which showed remarkable stability during both periods, and the Pacific/Asia, which experienced only a minor deceleration.

During the next 10 years, economic growth should average between 2.4 and 4.3 percent for the major world regions, as shown by the chart on the following page. On a worldwide basis, economic development is forecasted to average 3 percent annually, somewhat higher than the 2.3 percent attained so far during the 1980s.

The pickup in forecasted growth, compared to that experienced since 1980, will be due to lower inflation, increased trade, and greater reliance on market forces to determine investment and prices. The highest growth rates should occur in the Pacific/Asia and the Middle East regions followed by Latin America. Inflation should remain stable as commodity prices show only small nominal increases due to ample supplies. Trade will continue to grow as many countries are forced to export more in order to service their foreign debts. Greater reliance on market forces should improve economic efficiency and result in a better allocation of resources and investment capital.

WORLD ECONOMIC OUTLOOK BY REGION



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YIELDS

Passenger yields (revenues per passenger-kilometer or mile) in real terms have steadily declined on a worldwide basis. World real yields have declined nearly 58 percent since 1950, an average decrease of 2.4 percent annually. During the last 10 years, this average decline intensified as real yields dropped 2.8 percent annually.

Airlines have been able to offer progressively lower fares in real terms primarily because of real operating cost reductions. Many factors have contributed to this, but the more significant are the use of more efficient aircraft and higher airline employee productivity.

In forecasting the direction of future real yields, the factors which contributed to the historical decline of real yields show no signs of abating. Each new aircraft model is more efficient than the last as improvements in propulsion efficiency, avionics, and the use of lightweight aircraft materials continue to provide airlines increased efficiency. And, capital investment by airlines will continue to make employees more productive, particularly with the emphasis on lean operations throughout the industry. Based on these considerations and the relatively flat real fuel prices previously discussed, it is reasonable to assume that real yields worldwide will decline further but at a more moderate rate, averaging 1.8 percent annually in the next decade. While it is recognized that there is a limit to which real yields can fall, that limit is considerably below today's levels.

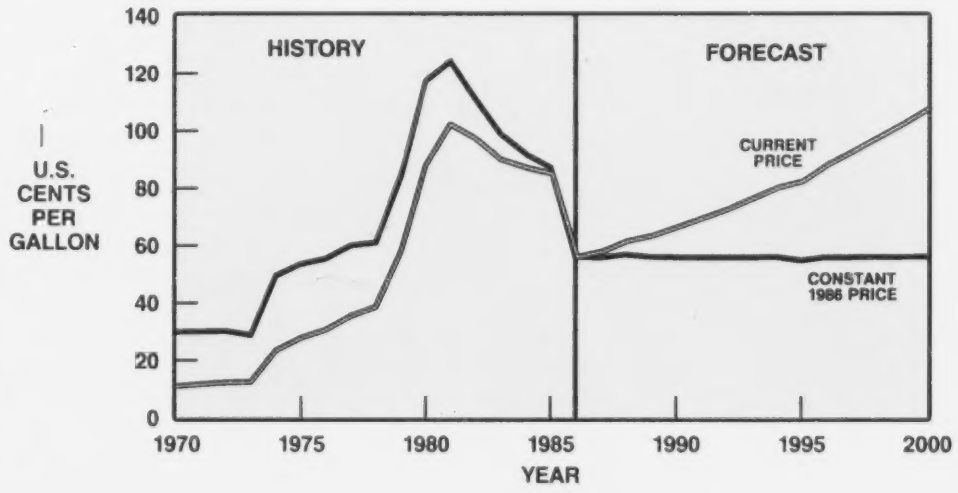
ENERGY

No major changes have been made in energy projections by Douglas Aircraft compared with last year. Oil is viewed as a commodity that faces a secular long-term price decline along with most other commodities. The high oil prices that have prevailed since 1973 represent an aberration rather than a new long-term trend. OPEC managed to keep prices artificially high because it controlled a high percentage of the export market and later because of its dramatic reduction in output. When Saudi Arabia reversed its past production cuts and rapidly expanded its oil production in early 1986, a dramatic fall in oil prices followed.

These past high oil prices sowed the seeds of subsequent price reductions. On the supply side, oil production overcapacity developed as too many resources were directed toward worldwide oil exploration. This caused OPEC's share of oil exports to deteriorate steadily during the 1980s. On the demand side, higher prices led to improved energy efficiency and conservation which resulted in lower demand. Since the mid-1970s, the amount of oil needed to produce a unit of world output has fallen steadily, reversing a previous long-term upward trend. These developments have resulted in current prices that are close to market-supportable levels.

The Douglas Aircraft base scenario assumes that current agreements on oil production quotas will be violated as producer countries need additional export revenues. Sufficient amounts of oil will be found so that the growth in demand will be roughly matched by increases in supply. The result should be stable real prices for oil and kerosene; i.e., prices will not rise faster than inflation. This is illustrated below. Of course, short-term fluctuations will occur, but over the next decade real prices should be near today's levels.

U.S. JET KEROSENE PRICE FORECAST



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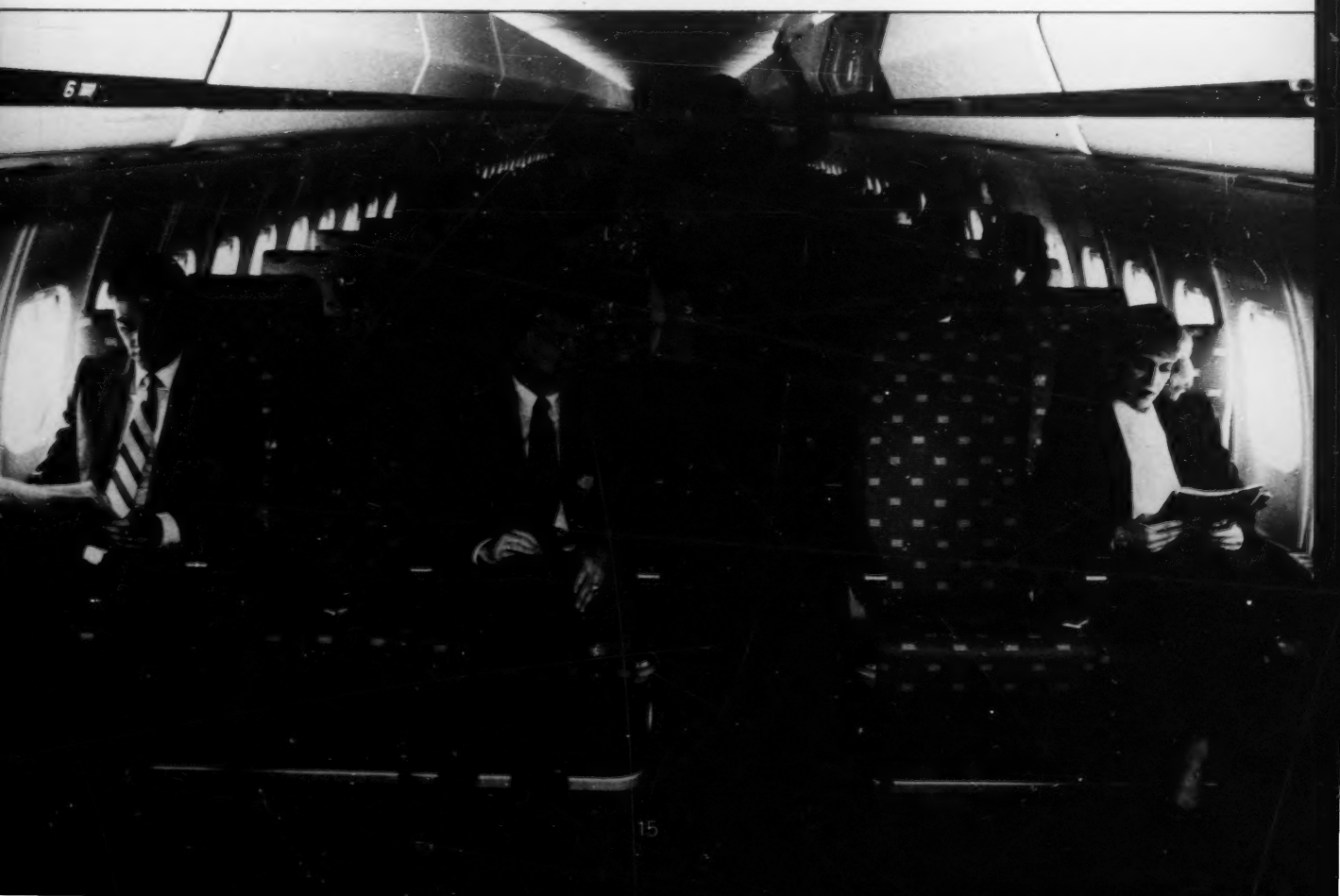
PASSENGER TRAFFIC AND CAPACITY



PASSENGER TRAFFIC AND CAPACITY

As the complexities of the airline industry grow at an accelerated rate, the timely analysis of its long-term potential becomes paramount. This year's passenger traffic forecast, which provides the basis for the fleet projection, has been developed using a variety of econometric techniques for 32 separate world routes which closely approximate those defined by the International Air Transport Association (IATA). Primary independent variables employed in these forecasts include country economic growth and real passenger yields. The economic growth for 69 countries is forecast using the Wharton Econometics' World Service Model in conjunction with data from other sources along with internally generated Douglas Aircraft Company input. Real passenger yield forecasts by route are developed using the Douglas Aircraft World Airline Model.

This year the passenger fleet forecast consists of an individual analysis of the 80 largest airlines. An additional 95 carriers are aggregated into five regions based on domicile: Europe, Pacific/Asia, Middle East, Africa, and Latin America. In total, 96 percent of the world's passenger traffic is represented by the fleet forecasts presented in this publication.

INDUSTRY OVERVIEW

Major structural changes transformed the U.S. airline industry in 1986, creating far-reaching implications for the world's aviation community. For the turbulent postderegulation era, 1986 can be characterized as a year of "Consolidation for Competitiveness" by U.S. airlines. With 12 acquisitions completed in 1986, three more announced 1986 acquisitions completed in 1987, and one 1986 acquisition of a major route system, significant restructuring occurred last year among the scheduled prederegulation carriers. U.S. airlines seem convinced that size is the most effective tool for competing in a deregulated environment. Of the 21 trunks, regional and local service airlines in scheduled existence just prior to the 1978 deregulation, only 11 carriers remain autonomous. The remainder have either been acquired or have discontinued their operations. Further consolidations are expected, with the resultant outcome of a few "mega-carriers" controlling the U.S. airline industry.

The dynamic effects of U.S. airline deregulation have carried over to other continents. In Europe and Asia, many state-owned flag carriers are in the process of becoming "privatized," with most or all of their stock being sold to private investors. Under private ownership, these carriers hope to become more productive and cost efficient in order to compete against the U.S. "mega-carriers" in the international marketplace. Other defensive responses by European airlines in the aftermath of deregulation have recently involved joint operations on selected routes as well as potential mergers. While extensive structural alterations to the industry have already been completed in North America, the restructuring of commercial aviation elsewhere is in its infancy. Further changes are expected in other world regions as a gradual reduction of the highly regulated aviation environment engenders more limited forms of industry regulation. Such a liberalization is anticipated within the European community by the early 1990s.

Passenger traffic (all services) posted a 5.5-percent gain in 1986, with worldwide revenue passenger-kilometers approaching 1.4 trillion. Partially moderating these results were the twofold effects of the Chernobyl nuclear disaster and the fear of terrorist activity in Europe. Scheduled traffic on the North Atlantic, which represents the largest international route, declined by nearly 6 percent for the year. The weakened U.S. dollar was also a factor. However, other routes benefited from Chernobyl and terrorist fears due to the diversion of considerable traffic from European destinations. Scheduled pas-

senger traffic on North America-South America routes increased over 15 percent in 1986, the best improvement since 1979. The sizable North- and Mid-Pacific scheduled market grew nearly 10 percent for the year, reflecting a continuance of high growth levels. And the dominant U.S. domestic market, which accounts for 39 percent of the world's scheduled revenue passenger-kilometers, was a significant benefactor from European travel fears. Also aided in part by deregulated fare wars, U.S. domestic passenger traffic rose nearly 12 percent for the second consecutive year.

A strengthened optimistic outlook for the long-term future of commercial aviation was witnessed in 1986. This was highlighted by the fact that a (net) total of 568 commercial jet aircraft were placed on firm order during 1986. The 1986 results represented one of the best years ever following an equally successful prior year when 558 net orders were booked. Furthermore, these booked orders advanced the world's commercial jet backlog to a sizable 1,228 units by the end of 1986, an increase of 24 percent from the 993-unit backlog a year earlier. It appears that this enthusiasm has been sustained as the pace of net order bookings has quickened through the first half of 1987.

The positive outlook by the airline industry has led the major airframe manufacturers to launch a number of new aircraft programs since early 1986. Among those have been the MD-11, MD-88, A300-600R, A330/A340, 737-400/737-500, 757PF, and 767-300ER. Several other new programs are in the design stage, with possible launch dates over the next few years.

With the high activity levels being generated in all phases of commercial aviation, the remainder of the twentieth century promises to be a dynamic, provocative, and challenging period for the world's airlines and suppliers alike.

TRAFFIC FORECAST

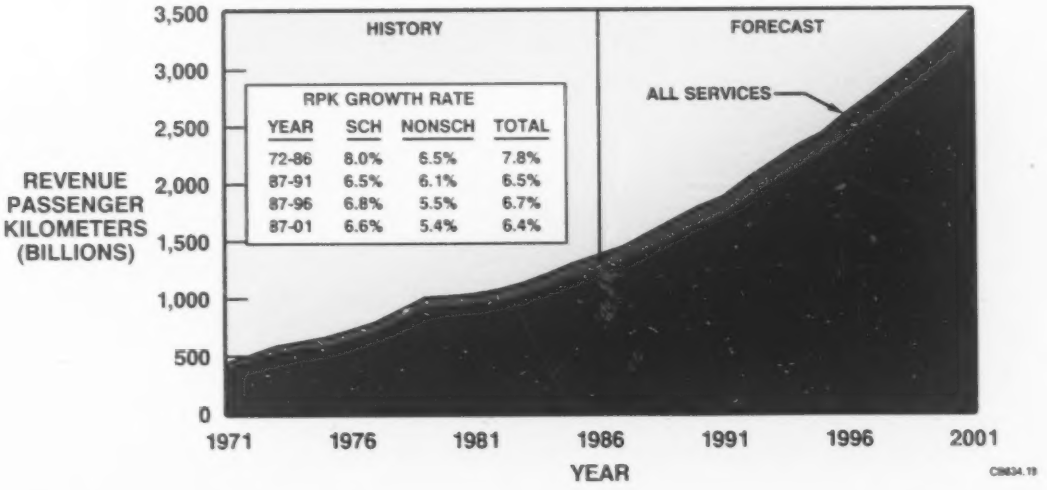
Predictions of passenger traffic growth primarily relate to the optimistic world economic climate expected to prevail over the long term. Real gross domestic product worldwide is forecast to average 3 percent annually during the next 10 years, somewhat higher than that actually achieved since 1976. Real passenger yield, the second important forecasting variable, is projected to decline by 1.8 percent per year, thus stimulating traffic volumes by making travel more affordable in real terms. This represents a considerable moderation compared to the historical yield decline of 2.8 percent annually during the past decade.

Other significant but less quantifiable factors relating to the airline industry's outlook involve improvement in operating efficiency and productivity. Advancement in such areas as reservations systems, yield management systems, flight management systems, aircraft composite technologies, efficient ultra-high-bypass propulsion systems, as well as a greater emphasis on two-man flight crews, will provide impressive gains in airline economies industrywide. Furthermore, with the trend toward consolidations creating a higher concentration of passenger traffic among fewer carriers, the resulting "economies of scale" will enhance airline productivity. However, the full potential of productivity-related advancements will not be realized until the problems in air traffic control and airport congestion are solved.

The long-term outlook for passenger traffic on a worldwide basis is for growth approximating 6.4 percent per year, somewhat lower than the 7.8 percent experienced during the past 15 years. The recovery years of the world economy are projected for 1988 and 1992, which will produce the highest growth rates over the forecast period amounting to 8.0 percent and 8.6 percent, respectively. By 2001, nearly 3.5 trillion revenue passenger-kilometers will be produced in all services (scheduled and nonscheduled). Scheduled services will grow slightly above this, averaging 6.6 percent, while

nonscheduled traffic is projected at a somewhat subdued 5.4-percent growth rate due to competitively priced scheduled fares. Thus, scheduled traffic, which accounted for 90.3 percent of the total in 1986, will increase its share to 91.7 percent by 2001.

TOTAL WORLD PASSENGER TRAFFIC
(SCHEDULED AND NONSCHEDULED SERVICES)



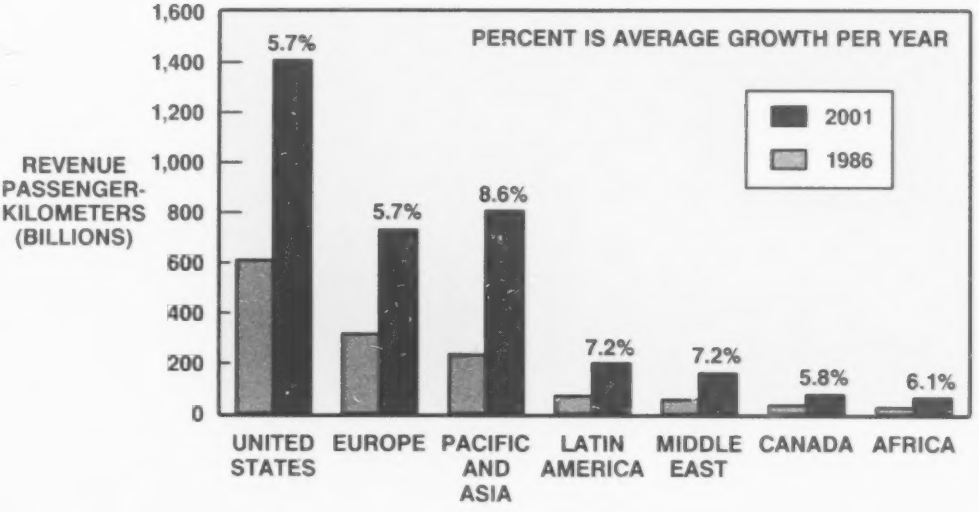
As regional economic patterns significantly influence transportation development, it can be readily ascertained that routes involving Asia will demonstrate the highest growth rates, as shown. Asia's continued economic expansion is estimated to exceed 4 percent annually. The North- and Mid-Pacific, Intra Far East and Pacific, Other Far East Domestic, and Europe-Far East routes will far exceed the expected performance of other major routes and the total industry as a whole. These four routes collectively accounted for 20 percent of the world's revenue passenger-kilometers in 1986; by 2001, however, these routes will represent nearly 30 percent of the world's passenger traffic. Much of this gain in world share will be attained at the expense of the mature U.S. Domestic market, which is forecast to develop at a level below the world average. The U.S. Domestic market is expected to decrease its relative world share by 6 percentage points, dropping from its lofty 38.5-percent share in 1986 to 32.5 percent by 2001.

SCHEDULED PASSENGER FORECAST BY MAJOR ROUTE

ROUTE	1987-2001 AVERAGE GROWTH (PERCENT)	PERCENT SHARE OF WORLD REVENUE PASSENGER-KILOMETERS 1986	2001
U.S. DOMESTIC	5.3	38.5	32.5
NORTH ATLANTIC	5.9	10.7	9.8
EUROPE-FAR EAST	8.2	7.4	9.2
NORTH AND MID-PACIFIC	10.1	5.6	9.2
INTRA FAR EAST AND PACIFIC	9.9	5.1	8.2
INTRA EUROPE	5.2	4.6	3.8
JAPAN DOMESTIC	6.3	2.6	2.5
OTHER FAR EAST DOMESTIC	9.0	2.2	3.0
EUROPE-MIDDLE EAST	5.1	2.0	1.6
TOTAL MAJOR ROUTES	6.7	78.7	79.8
TOTAL WORLD	6.6	100.0	100.0

As a consequence of the exceptional development of Asian routes, it is apparent that air carriers based in the Pacific and Asia will prosper substantially. Passenger traffic carried by these airlines is forecasted to expand by 8.6 percent annually through 2001, as shown. A considerably slower growth is anticipated for U.S. and Europe domiciled airlines with a 5.7-percent increase, which even lags behind the 6.4-percent world average. In 1986, European airlines produced 35 percent more revenue passenger-kilometers than carriers based in the Pacific and Asia. By 1998, however, it is expected that the Pacific and Asia carriers will surpass European operators in passenger traffic volume, reflecting the impact of Asia's economic expansion on its airline community.

PASSENGER TRAFFIC BY DOMICILED AREA
(ALL SERVICES)



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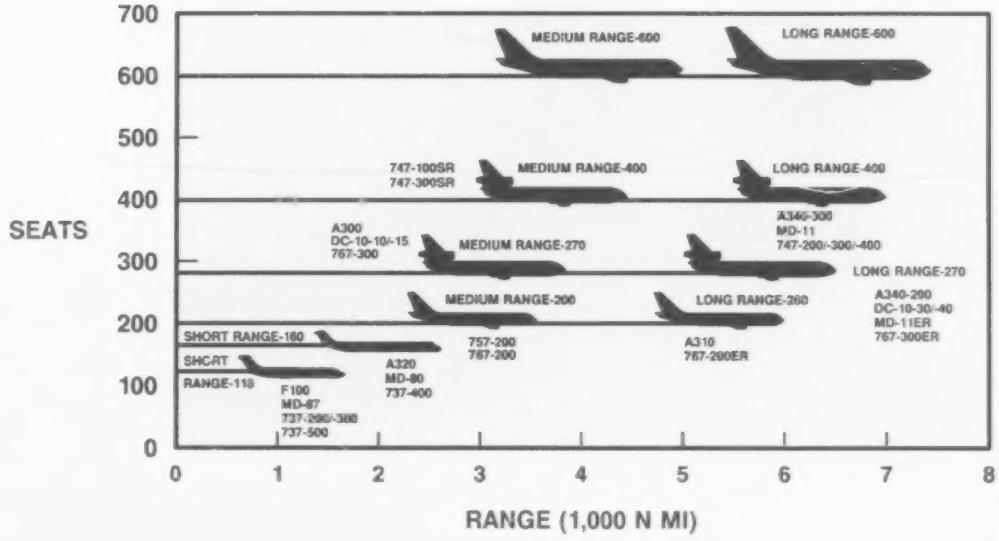
CAPACITY ASSUMPTIONS

The segmented classes of generic jet aircraft used in this study are based on seating capacity and range. This is illustrated along with the currently produced and planned models representative of each class. It should be noted that this year's analysis includes the addition of a Long Range-200 class due to the recent launch of aircraft programs designed to fill this void. Aircraft in the Medium and Long Range-600 category are assumed not to be available until 1994.

In assessing future aircraft demand, the retirement of current aircraft in today's fleet must be considered. Retirement schedules were analyzed in relation to specific airline philosophies concerning aircraft purchases, service life, and operating environment. The general criteria adopted for this study include (1) the retirement of narrow-body equipment after 25 years of useful service life and (2) the retirement of wide-body aircraft after 25 to 30 years. These basic retirement guidelines are deemed to be conservative for analytical purposes in order to minimize the risk inherent in new aircraft demand forecasts.

The basic retirement assumptions make no attempt to phase out Stage II aircraft in the United States before their useful life expectancy, since no legislative actions currently apply to such aircraft at the Federal level. Limited restrictions concerning noise problems have been enacted only by local airport

PASSENGER AIRCRAFT
GENERIC TYPES



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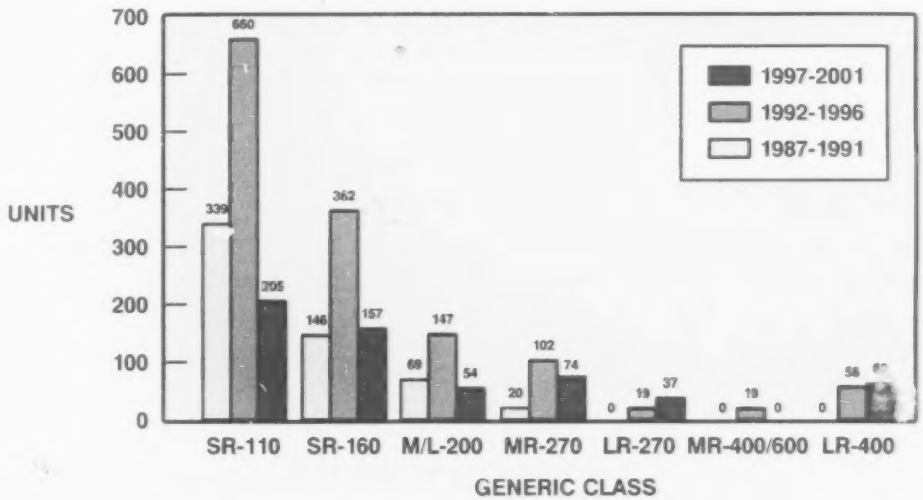
authorities. While most proposals regarding phase-out of Stage II aircraft in the U.S would produce minimum impact, it is considered prudent to exclude such possibilities from this analysis until a more definitive policy is established.

In summary, over 2,500 aircraft of the world's 6,200-unit fleet will be retired during the next 15 years. The peak retirement period is expected to be the 1992 through 1996 time frame when about 54 percent of the total retirements will occur. This primarily reflects the retirement of vast numbers of DC-9, 727, and 737 aircraft delivered during the latter half of the 1960s.

PASSENGER AIRCRAFT RETIREMENTS BY FIVE-YEAR INCREMENTS



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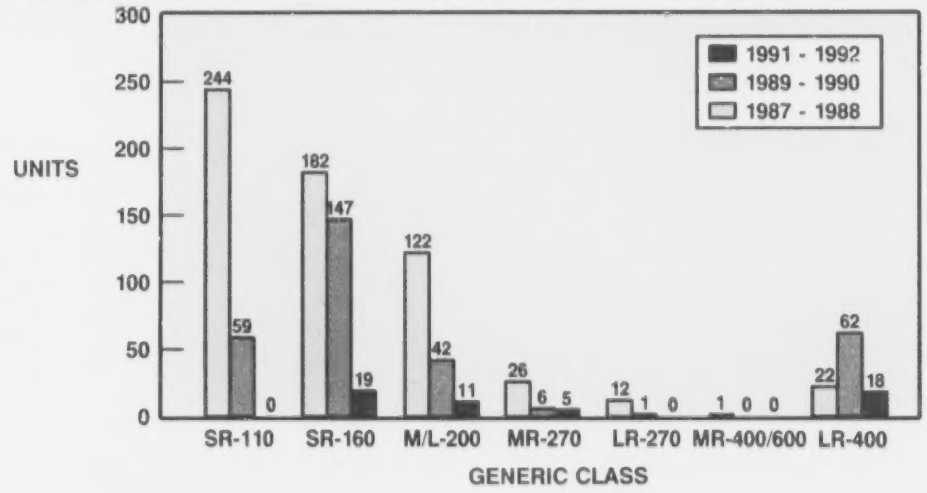
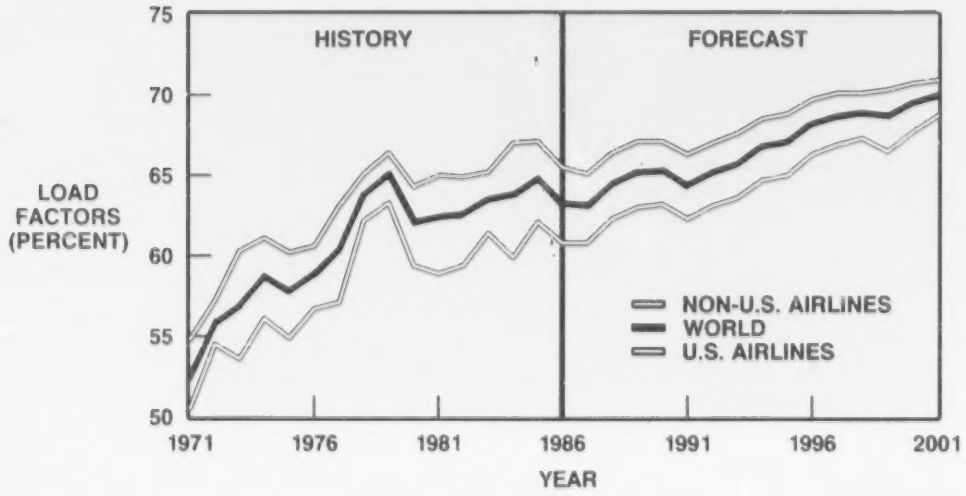
Aircraft currently on order must also be factored into this analysis. Such aircraft are defined as those announced orders of firm and conditionally firm units in effect at the end of 1986. This is shown by generic class according to the planned delivery date. Of the nearly 1,000 aircraft on order industry-wide, over 60 percent will be delivered by the end of 1988. This primarily represents short-range equipment ordered in substantial quantities the past few years. Deliveries of the remaining aircraft on order will for the most part be completed by 1990.

PASSENGER AIRCRAFT ON ORDER BY DELIVERY DATE



Load factors are expected to trend somewhat higher as airline planning efficiencies improve. The primary elements contributing to this are twofold. First, reservations systems will continue to provide state-of-the-art booking control improvements. Large international consortiums of carriers are beginning to pool their resources to develop, maintain, and improve advanced reservations systems which will allow them to operate with higher load factors while turning away fewer passengers.

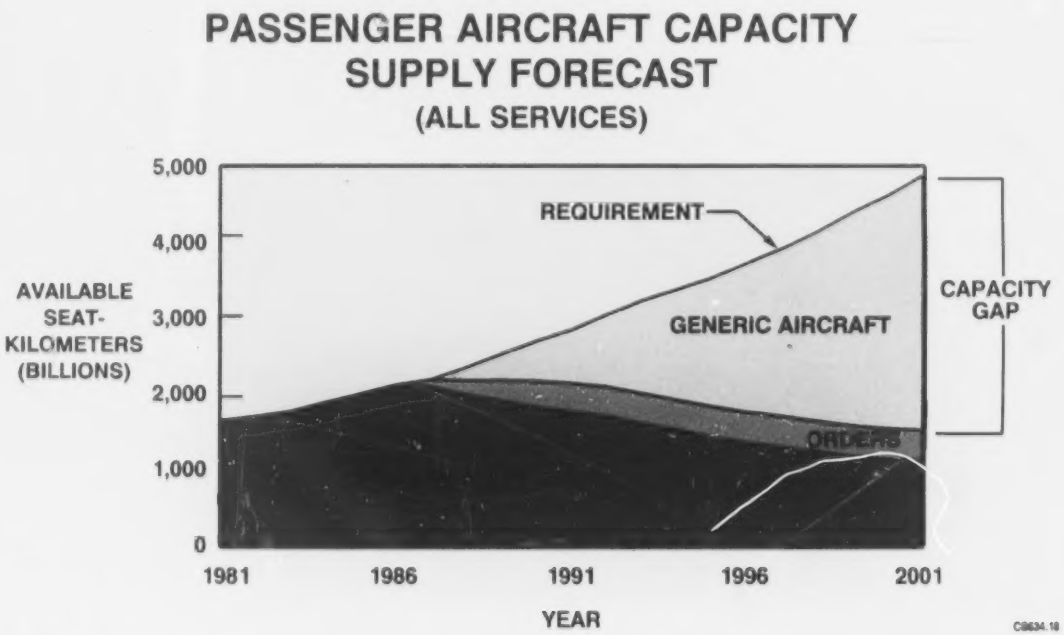
AVERAGE PASSENGER LOAD FACTORS
(ALL SERVICES)



Second, new airline yield management systems are being designed to incorporate revenue enhancement methodologies with the ability to turn away the lowest-revenue-producing passengers. Thus, industry load factors are projected to climb to 70 percent by 2001. Load factors of U.S. airlines, traditionally lower than the industry, are assumed to remain below the world average partially as a result of their deregulated domestic environment.

CAPACITY REQUIREMENT FORECAST

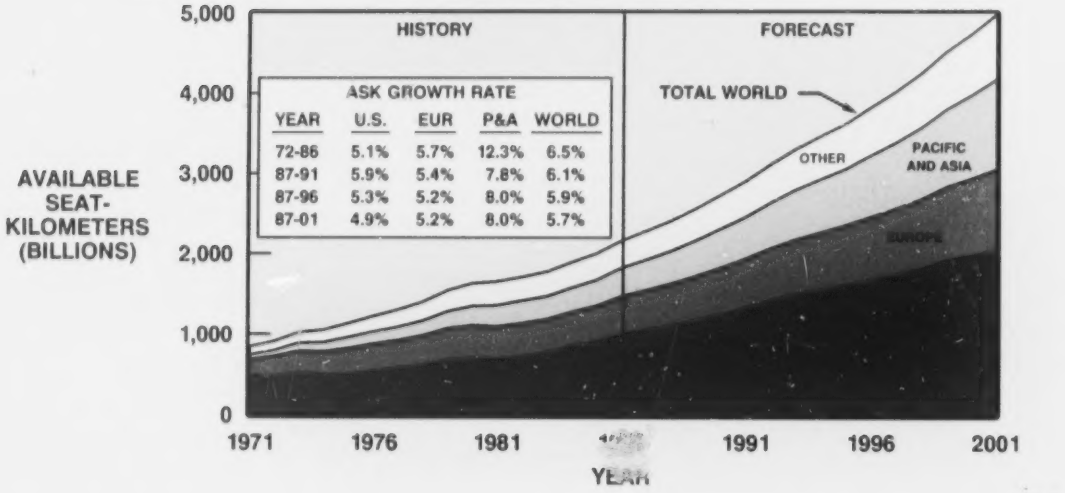
Given the passenger traffic forecast and aircraft load factor assumptions, the resulting available seat-kilometers reflect the total capacity required on a worldwide basis, as illustrated by the top line on the following chart. By 2001, 4.9 trillion available seat-kilometers will be necessary to carry the projected traffic level. The current fleet will decline from a 2.1 trillion available seat-kilometer production in 1986 to 1.1 trillion ASKs by 2001 after future retirements are considered. Capacity provided by aircraft currently on order will account for an additional 406 billion ASKs by 2001. The differential between the total requirement and the ASK production supplied by current aircraft plus those on order, represents the capacity gap which will be filled by new orders of generic equipment. This gap totals 3.4 trillion ASKs or about 70 percent of the total requirement in 2001. The size and range of new generic aircraft necessary to fill the capacity gap is discussed in the following section.



The total capacity requirement shown previously is distributed by domiciled area on the following page. The domiciled capacity requirements are reflective of the generic types of aircraft that will be necessary to fit the route systems of the airlines involved. In particular, sustained economic development in Asia will provide an impetus to traffic growth and, consequently, to the available capacity required. Capacity for carriers based in the Pacific and Asia is collectively forecast at an average growth of 8 percent per year through 2001, after increasing 12 percent annually over the last 15 years. The two other principal areas of domicile, Europe and the United States, will require considerably smaller capacity increases.

PASSENGER CAPACITY REQUIREMENTS BY DOMICILED AREA

(ALL SERVICES)



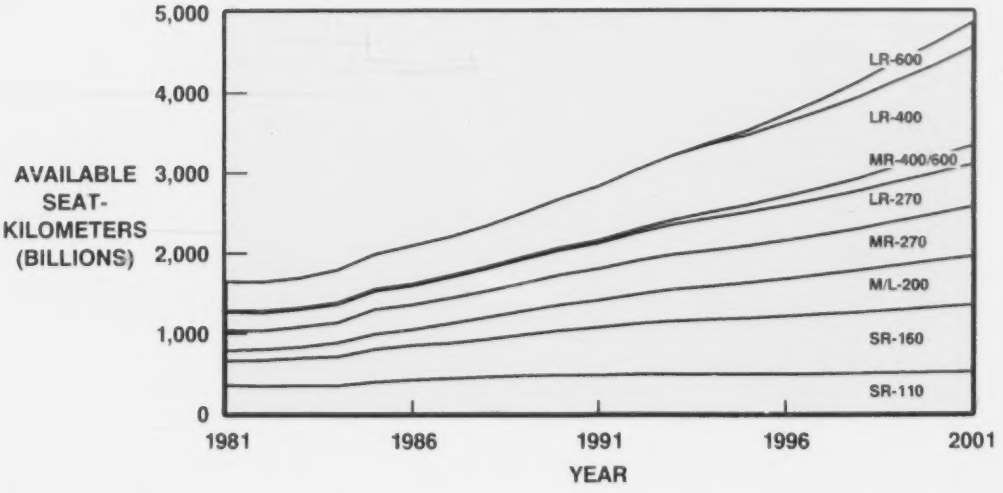
In summary, the projected 6.4-percent annual gain in worldwide passenger traffic will be transported by a 5.7-percent annual growth in available capacity based upon an average load factor which will increase 6 percentage points over the time frame.

PASSENGER FLEET

CAPACITY TRENDS

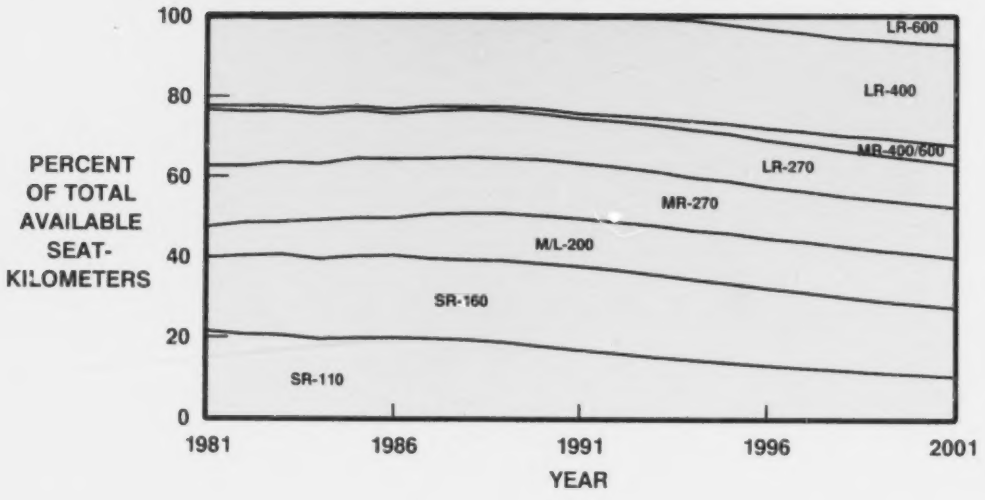
In analyzing passenger aircraft demand by generic class, capacity trends play a significant role in the determination of unit requirements. The required 5.7-percent annual capacity development previously discussed is illustrated below and segmented by the generic classes.

PASSENGER CAPACITY TRENDS BY GENERIC CLASS



While the capacity provided by each class will increase during the forecast period, certain classes will outperform others in relative terms. The following chart graphically illustrates these subtle changes. As airports become increasingly congested with flights and traffic, an emphasis on larger aircraft will result in general. While short-range aircraft will continue to provide an increasing level of capacity, the relative proportion of capacity supplied by these aircraft will decline from about 41 percent currently to 28 percent by 2001. Stronger growth prospects for intercontinental passenger markets will proportionately increase the capacity supplied by long-range equipment by 8 percentage points. Anticipated demand for 600-passenger long-range aircraft during the 1990s will consume much of the increase in this category. The required capacity supplied by medium-range aircraft will increase by 5 percentage points, emanating primarily from demand for 200-passenger medium-range aircraft in the M/L-200 segment.

PASSENGER CAPACITY PERCENTAGES BY GENERIC CLASS



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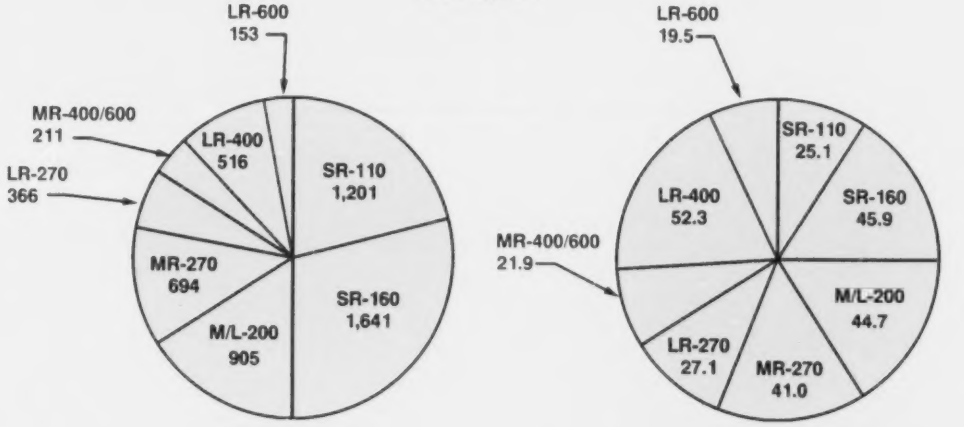
NEW PASSENGER AIRCRAFT REQUIREMENTS

Worldwide demand through 2001 for new passenger aircraft (over and above those currently on order) is forecasted at nearly 5,700 units with a total value amounting to $278 billion. Short-range jets will represent one-half of the unit demand but only one-fourth of the total value. Approximately two-thirds of the short-range unit demand is attributed to the retirement of substantial numbers of aircraft delivered during the late 1960s and early 1970s. Also noteworthy is the Long Range-400 class which will account for the largest revenue segment at $52 billion, or 19 percent of total value. In units, however, this class will represent only 9 percent.

GENERIC PASSENGER AIRCRAFT REQUIREMENTS*

1987-2001



*EXCLUDES AIRCRAFT CURRENTLY ON ORDER

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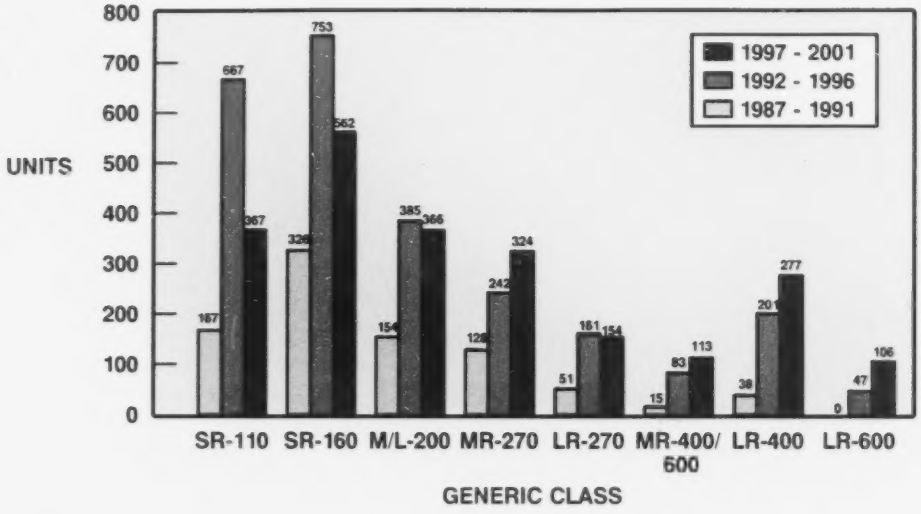
In terms of timing for the 5,687 new-aircraft requirement, approximately 45 percent of the total demand will be necessary during the 1992-1996 period. This will partially result from substantial replacements of retired aircraft in the short-range class and first-generation wide-body equipment. The last 5-year period will also produce significant demand for new aircraft, representing 40 percent of the 15-year total. As passenger traffic builds, demand for wide-body aircraft will steadily increase and reach its highest level during the 1997 through 2001 time frame. It should be noted that the 1988 to 1991 period appears relatively low in units required due to the exclusion of aircraft already on order.

GENERIC PASSENGER AIRCRAFT REQUIREMENTS BY FIVE-YEAR INCREMENTS

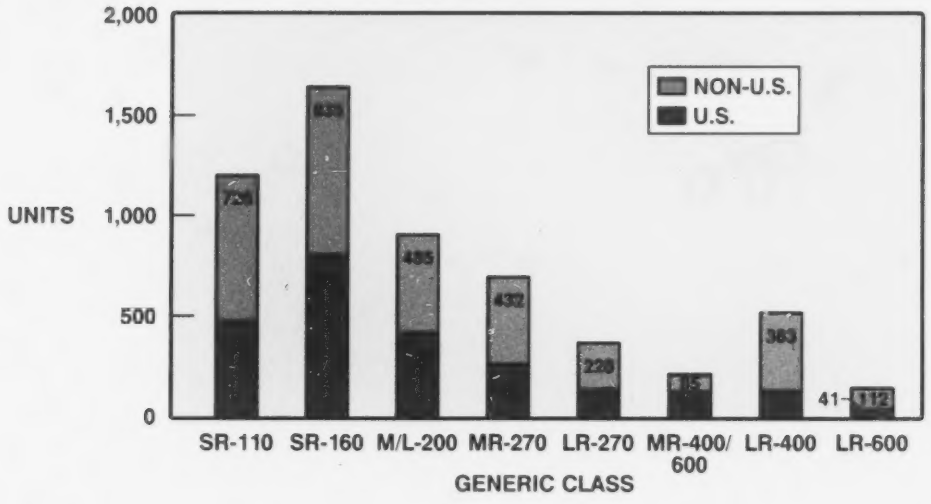


Airlines based in the United States operated 47 percent of the world's passenger aircraft in commercial service last year. U.S. carriers also account for 47 percent of the world's 981 aircraft which were on order at the end of 1986. However, considering new passenger aircraft requirements through 2001, demand by U.S. airlines is estimated at a somewhat modest 42 percent of total units. However, in certain market segments, including the Short Range-160, Medium and Long Range-200, and Medium Range-400 and 600, U.S. carrier share will be significant. U.S. unit demand is illustrated by generic class on the next page.

Partially explaining the proportionately moderate U.S. demand is the anticipated growth of Pacific and Asian carriers. While airlines based in the Pacific and Asia currently account for 12 percent of the world's commercial unit inventory, it is forecasted that they will represent 19 percent of the total demand for new passenger aircraft. This will equal the projected demand by European carriers, which collectively represent over 22 percent of the world's commercial fleet today. Non-U.S. carriers will

GENERIC PASSENGER AIRCRAFT REQUIREMENTS BY DOMICILED AREA

1987-2001



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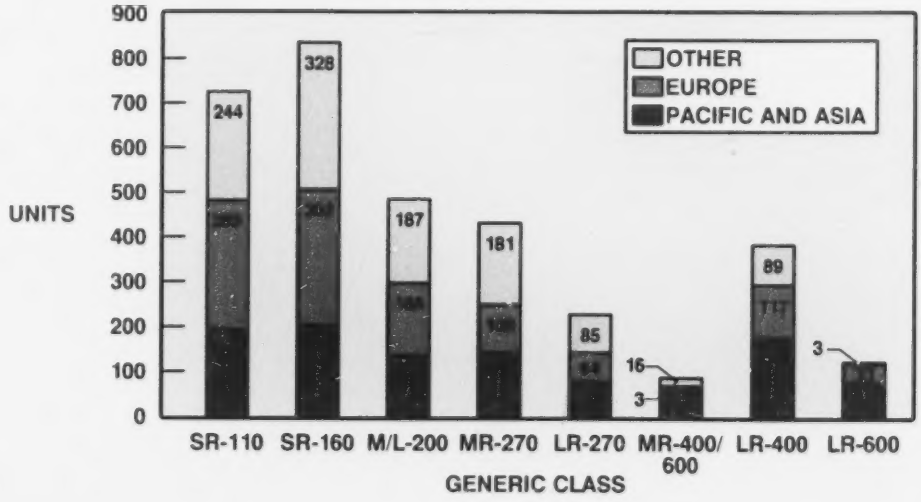
account for nearly 3,300 aircraft through 2001 as shown, or about 58 percent of the world total. Carriers domiciled in the Pacific/Asia and Europe will each require nearly 1,100 aircraft, although the latter will need considerably more small, short-range aircraft which are valued far less than those units required by the former. Other non-U.S. domiciled carriers will also demand about 1,100 units, with Latin American airlines accounting for one-half of this amount.

GENERIC PASSENGER AIRCRAFT FOR NON-U.S. AIRLINES BY DOMICILED AREA

1987-2001



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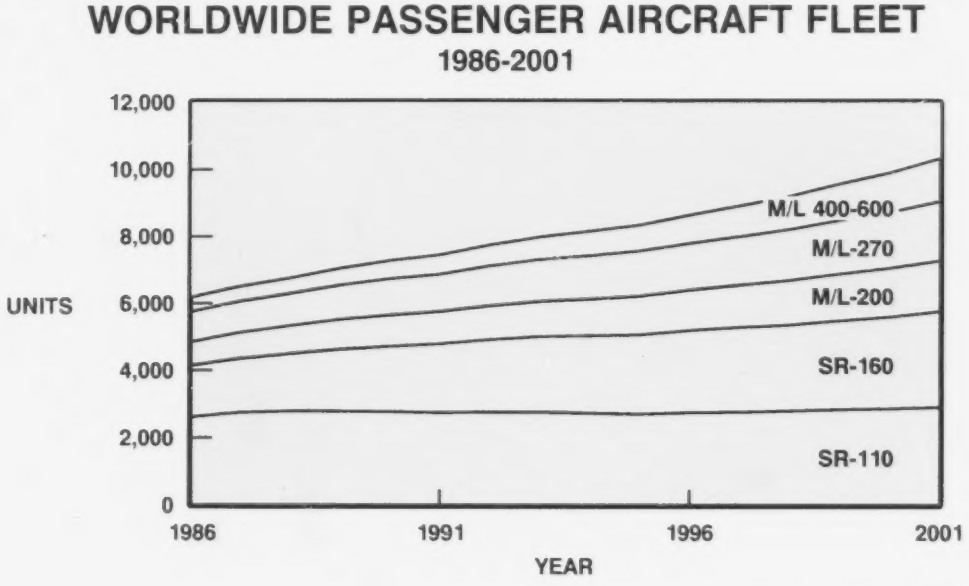
PASSENGER FLEET COMPOSITION

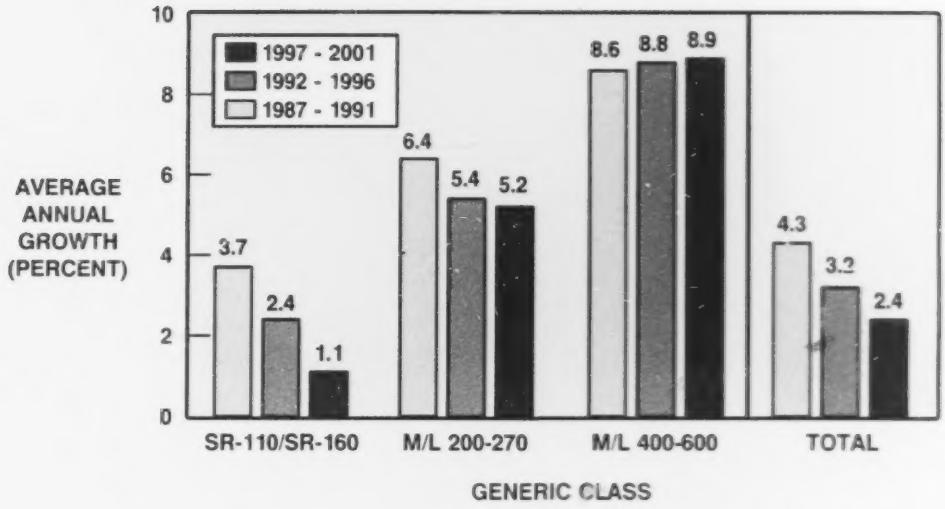
Considering the previously discussed retirements, current orders and forecasted generic demand, the worldwide passenger aircraft fleet is projected to expand to over 10,300 units by 2001, an increase of 67 percent compared to the 1986 level. A majority of this 4,200-unit increase will be attributed to higher demand for medium- and long-range equipment, which will collectively more than double in units over the forecast period. The M/L 400-600 segment will demonstrate the fastest increase by tripling in units. Overall, medium- and long-range aircraft, which currently represent one-third of the world's passenger fleet, will expand to a 44-percent share of world units. The SR-110 class will demonstrate little unit growth as greater emphasis is placed on larger equipment in the SR-160 class, which increases in units by 86 percent.



Reflecting the conservative predictions of the world fleet growth previously shown are the moderate departure increases which have been allowed. These are in line with attainable projections by the Federal Aviation Administration and other civil aviation organizations throughout the world. Increased demand for medium- and long-range aircraft will escalate departures of these classes at a faster pace than the short-range class. On average, departures worldwide will grow 3.2 percent over the next 15 years. Departure growth by generic aircraft segments is summarized in the chart on the following page.

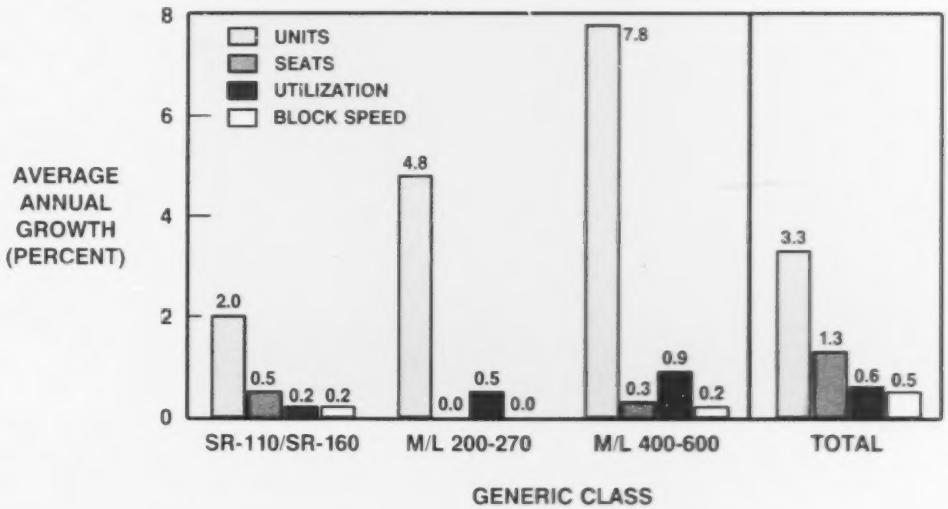
The required 5.7-percent average capacity increase is achieved by changes in the four components that equate to available seat-kilometers productivity: the number of aircraft units, number of seats per aircraft, daily aircraft utilization, and aircraft speed. With operational limitations imposed by the latter three components, aircraft unit growth will provide most of the productivity increase. This is shown by the lower chart on the next page. In general, nearly 60 percent of the total ASK productivity gain will be attributed to the addition of aircraft in the world's fleet. This will be more predominant in

WORLD DEPARTURE GROWTH BY FIVE-YEAR INCREMENTS



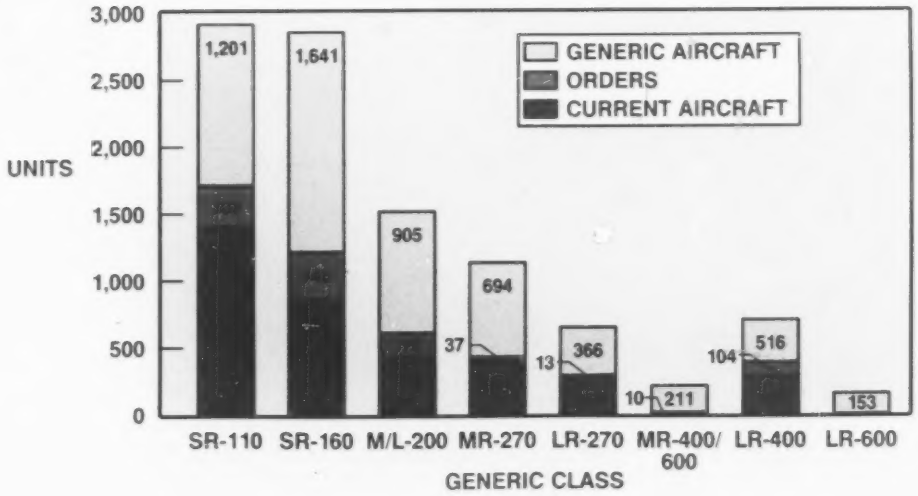
larger seat size classes where smaller quantities of aircraft exist. With the average seat count within the M/L 400-600 category increasing to meet the expected demand for a 600-passenger aircraft during the late 1990s, seat growth for the total fleet will average 1.3 percent annually, thus accounting for nearly one-fourth of productivity gains. Utilization and block speed increases will each play a relatively subordinate role in ASK development, inhibited by operational constraints.

PASSENGER AIRCRAFT PRODUCTIVITY GAINS THROUGH 2001



The world passenger fleet, which should number about 10,300 aircraft in 2001, will be composed of aircraft currently in service (at year-end 1986), aircraft on order at the end of 1986, and new generic aircraft. Current aircraft remaining active in 2001 — after retirements are considered — will account for 35 percent of the total fleet, units on order will approach 10 percent, while forecasted new generic demand will reach 55 percent of the total. The short-range classes will still dominate in units as each will approximate 2,900, although the Short Range-110 class will show little relative growth. Most of other generic classes, however, will roughly double their current fleet counts by 2001.

PASSENGER FLEET COMPOSITION IN YEAR 2001



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CARGO TRAFFIC AND CAPACITY

CARGO TRAFFIC AND CAPACITY

The 1987 analysis of the world's air cargo industry is compatible with the 1986 outlook, since no significant structural changes occurred in the past year. Growth in the small package/express parcel segment continued to represent the most progressive air cargo sector, and it is again analyzed along with the full-service integrated operators and traditional airlines. Like last year's publication, all feeder and nonjet services are excluded from the results. The air cargo traffic forecasts, which provide the basis for the fleet projections, are developed from regional econometric analyses. Then, detailed freighter service analyses are produced on an individual carrier basis culminating in a forecast of long-term fleet requirements. These analyses represent about 98 percent of the world's total freighter cargo. All regions and route definitions are based on those used by the International Air Transport Association (IATA).

INDUSTRY OVERVIEW

Air cargo for 1986 can be characterized as a developmentally sound year with few structural changes. With a stabilizing world economy, total air cargo in 1986 continued its upward momentum with an advance of 8 percent over the sluggish 1 percent gain experienced in 1985. The traffic routes that produced the most significant improvement were all Asia-related: the North- and Mid-Pacific market, the Europe-Far East market and the Intra Far East and Pacific market. With considerable optimism envisaged for an expansion of industrialization to the "lesser developed" Asian countries, long-term cargo potential for this region appears bright.

The U.S. small package/express parcel segment again demonstrated its resilience by outpacing all other segments in growth. This sector was stimulated in part by a decline in yields brought about by an intensification of competition and an increase in the available service levels and service coverage. Heightened competition has forced the integrated operators into a bidding war for the high-volume shipping contracts of large corporate customers. As an increased strain is put on profitable yield levels, the eventual result will be a shake-out of the small express package operators with a variety of consolidations and mergers taking place. This trend has already begun on a small scale and is anticipated to accelerate in the future. It is expected that only today's stronger carriers and those with lucrative niches will survive.

As U.S. domestic markets are becoming saturated, larger express operators have looked to the international arena for expansion. The North Atlantic has been the initial focal point for express package market growth, resulting in significant increases of express flights and service levels. The next high potential battleground will be the North- and Mid-Pacific market. The Department of Transportation selection of a U.S. small express package operator to serve Japan is scheduled for this year. Furthermore, several international express networks are being formed by U.S. and non-U.S. entities to serve the North- and Mid-Pacific, as well as other international markets. The "internationalization" of the small express package industry is surging for non-dutiable items in addition to documents. However, a limiting factor is being placed upon dutiable items by customs procedures governing such commodities. Many in the industry feel that a relaxation of dutiable customs regulations is required to make this sector grow substantially.

The recent structural changes in the airline industry have had a greater effect on the passenger market than the cargo sector thus far. These changes include (1) the formation of the U.S. "mega-carriers" brought about by mergers, (2) the privatization of government-owned carriers, and (3) the

institution of joint operations among European airlines. The full impact of such actions upon the air cargo industry is not yet understood, except that increased competition among stronger carriers will again put more strain on profits. It will be increasingly necessary to constrain costs and improve both productivity and efficiency.

Air cargo shippers are demanding higher service levels as global trade and competition intensify. With distribution costs under close scrutiny, the "just-in-time" inventory concept will gain increased acceptance as industry seeks to optimize efficiency and reduce costs. This will undoubtedly carry far-reaching long-term implications for air cargo operators.

TRAFFIC FORECAST

The previously described forecasts of economic growth and inflation provide the basis for this cargo forecast and indicate continued stability among industrialized countries — a favorable implication for world trade. Air freight yields (another significant forecasting variable) have continued to erode, and are projected to decline further in real terms but at a more moderate rate in anticipation of intensified competition and increased availability of lower hold capacity. This will further encourage demand for the air freight product.

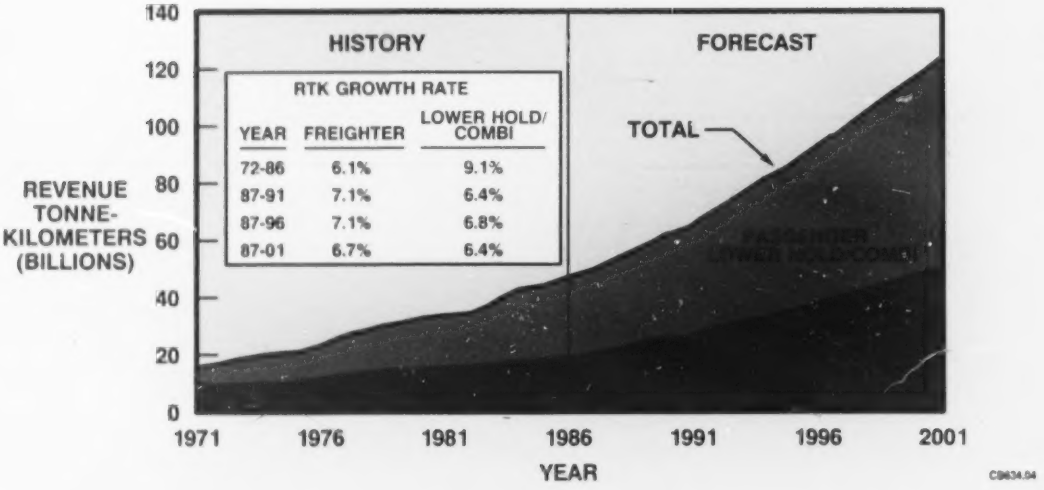
Other positive influences for the development of profitable air cargo services involve cost-control measures already instituted by most carriers. Such factors as nonunion labor, wage rollbacks, leaner but service-oriented operations, two-man flight crews, and moderation of fuel price increases will continue to stimulate growth within the air cargo industry.

Furthermore, technology-driven efficiency advancements will contribute to the industry's long-term prospects, such as ultra-high-bypass propulsion systems that dramatically reduce fuel costs. These and other technological breakthroughs currently being tested will appear on aircraft during the next decade. Progress in automated documentations procedures, computerized interface capabilities, and customs clearance efficiencies will increasingly enhance the service aspect of cargo transportation. Continued improvement in air cargo service levels will be demanded by shippers, and it will be required to broaden markets and further widen the service quality gap between air cargo and surface transportation.

The forecast for worldwide cargo growth through the year 2001 averages 6.5 percent per year, reaching 123 billion revenue tonne-kilometers from the 47 billion attained in 1986. This is graphically illustrated on the next page. While annual growth rates vary considerably, highest gains (those exceeding 8 percent) are projected for 1988 and 1992, which are foreseen as recovery years for the world economy. Despite the available increases in containerized cargo capacity attributed to the influx of wide-body passenger and "combi" aircraft, the emphasis on service in air cargo transport will enable freighter revenue tonne-kilometers to develop more rapidly than traffic on passenger flights. Freighter cargo is expected to improve annually at 6.7 percent over the next 15 years versus a 6.4-percent average for cargo on passenger-oriented flights. This reverses the trend of the past 15 years.

Considerable disparity is expected in regional economic development patterns during the forecast period, thus producing major differences in route traffic expansion, as shown by the table on the following page. Scheduled cargo is projected to grow at the highest rates on the three Asian routes (Intra Far East and Pacific, North- and Mid-Pacific, and the Europe-Far East market). While these routes currently constitute about 35 percent of the world's total scheduled cargo, by 2001 they will account for approximately 47 percent, thus demonstrating the significance of Asian trade to the

TOTAL WORLD CARGO TRAFFIC
(ALL SERVICES)



world's economy. As industrialization spreads across Asia in search of lower cost manufacturing capabilities, many of these "developing" nations could well emulate Japan's trade and economic progress. Also noteworthy are the mature U.S. Domestic and North Atlantic markets which decline considerably in relative size over the forecast period.

SCHEDULED CARGO FORECAST BY MAJOR ROUTE *

ROUTE	1987-2001 AVERAGE GROWTH (PERCENT)	PERCENT SHARE OF WORLD REVENUE TONNE-KILOMETERS 1986	2001
U.S. DOMESTIC	4.0	20.7	14.6
NORTH ATLANTIC	4.9	18.9	15.1
EUROPE-FAR EAST	8.2	15.4	19.6
NORTH AND MID-PACIFIC	8.4	13.5	17.9
INTRA FAR EAST AND PACIFIC	9.3	6.3	9.5
EUROPE-SOUTHERN AFRICA	6.0	3.4	3.2
EUROPE-MIDDLE EAST	5.5	2.7	2.4
NORTH AMERICA-SOUTH AMERICA	7.0	2.2	2.4
SOUTH ATLANTIC	8.2	1.9	2.4
INTRA EUROPE	3.0	1.9	1.1
TOTAL MAJOR ROUTES	6.5	86.9	88.2
TOTAL WORLD	6.4	100.0	100.0

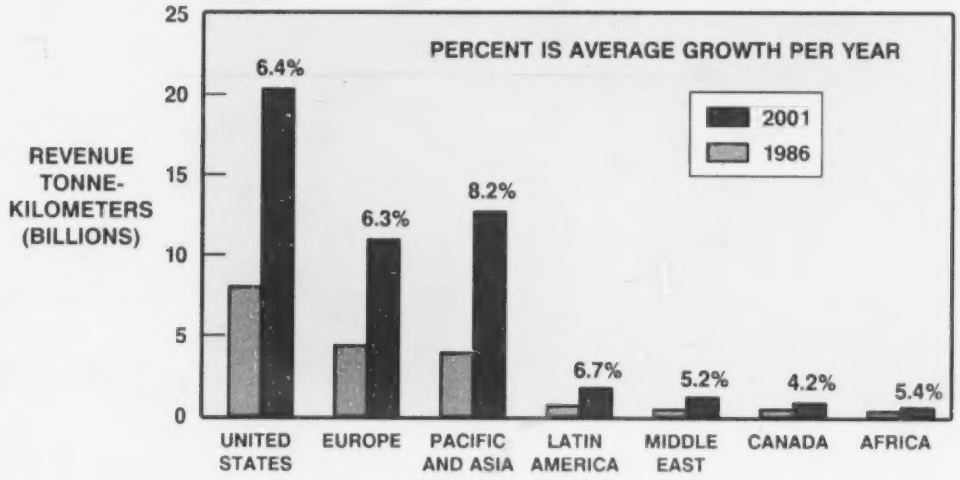
*INCLUDES "TYPE 418" CARRIERS

C8634.11

With high growth prospects for Asian air cargo routes, freighter operations of carriers based in Asia and the Pacific are forecast to develop faster than any other region. This should approximate an

8.2 percent annual pace, and enable the Pacific/Asia carriers to surpass European-based freighter operations as a whole by the early 1990s. Freighter traffic is expected to develop at substantially lower levels in all other regions, as shown below.

FREIGHTER CARGO BY DOMICILED AREA
(ALL SERVICES)



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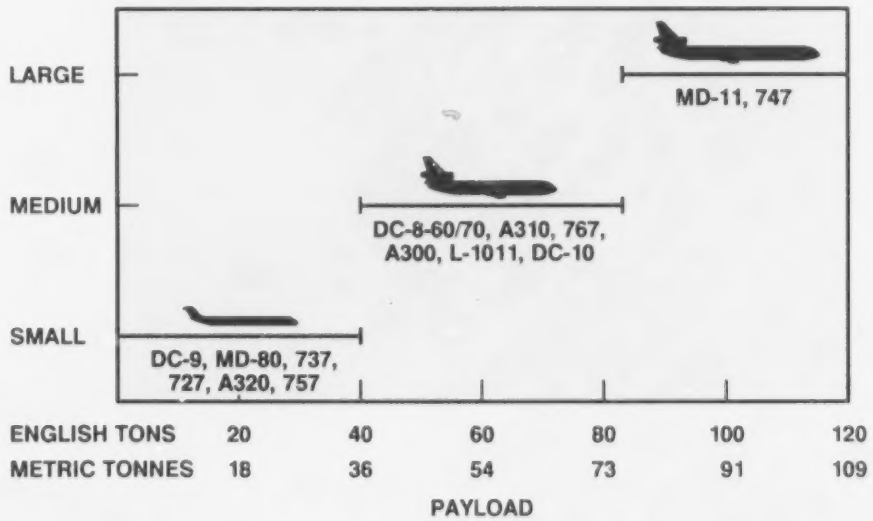
FREIGHTER CAPACITY ASSUMPTIONS

The three freighter classifications used in this study are based on payload. As shown below, the small category consists of freighters with maximum payloads up to 40 tons, the medium class between 40 and 85 tons, and the large class with payloads over 85 tons. The aircraft models are representative of each class, but also include other current and proposed aircraft.

GENERIC FREIGHTER CLASSES



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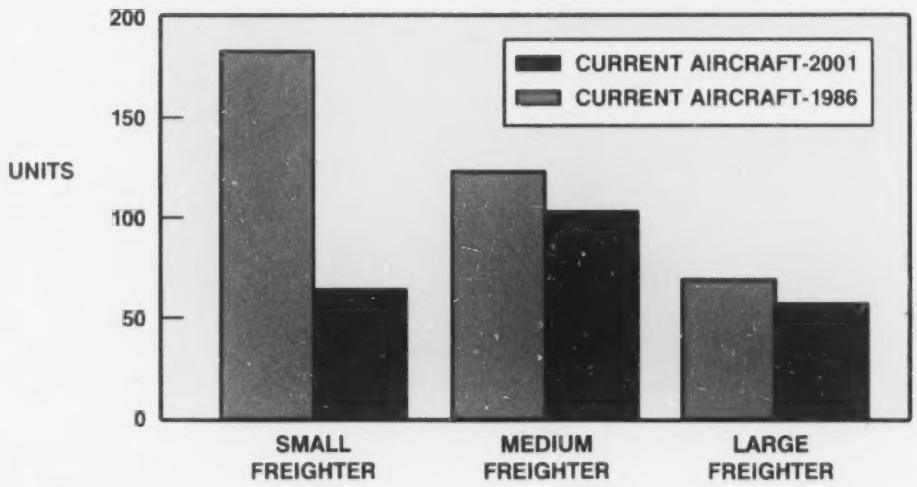
In anticipating future demand for freighter aircraft, retirements of current in-service aircraft must be considered. A very conservative retirement schedule has been forecast, as shown, thereby producing a high retention level of today's freighters through 2001. A lower proportion of today's small freighters is retained due to planned retirements of the less efficient short-fuselage aircraft in this class by current operators. Overall, approximately 60 percent of the world's active freighter fleet at the end of 1986 is assumed to continue in service through 2001, despite the fact that many of these aircraft have already accumulated a high number of flight hours. On a productivity basis, however, this percentage is much higher due to moderate retirements in the medium and large classes.

CURRENT AIRCRAFT RETAINED THROUGH YEAR 2001



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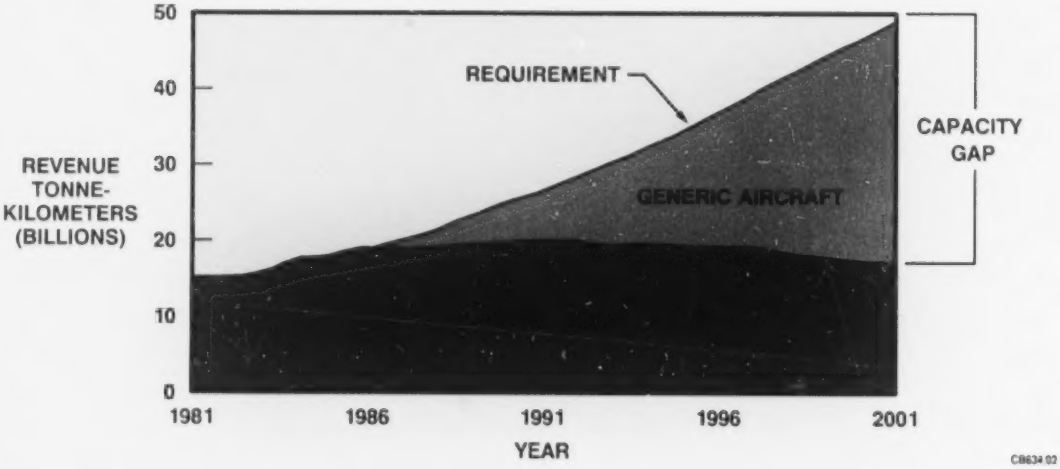
This retirement schedule has not considered any acceleration of Stage II aircraft phase-outs within the U.S. due to noise restrictions. If further limitations were enacted against Stage II aircraft, substantially more retirements would be necessitated, resulting in the requirement for considerably more new and converted Stage III freighters.

FREIGHTER CAPACITY REQUIREMENT FORECAST

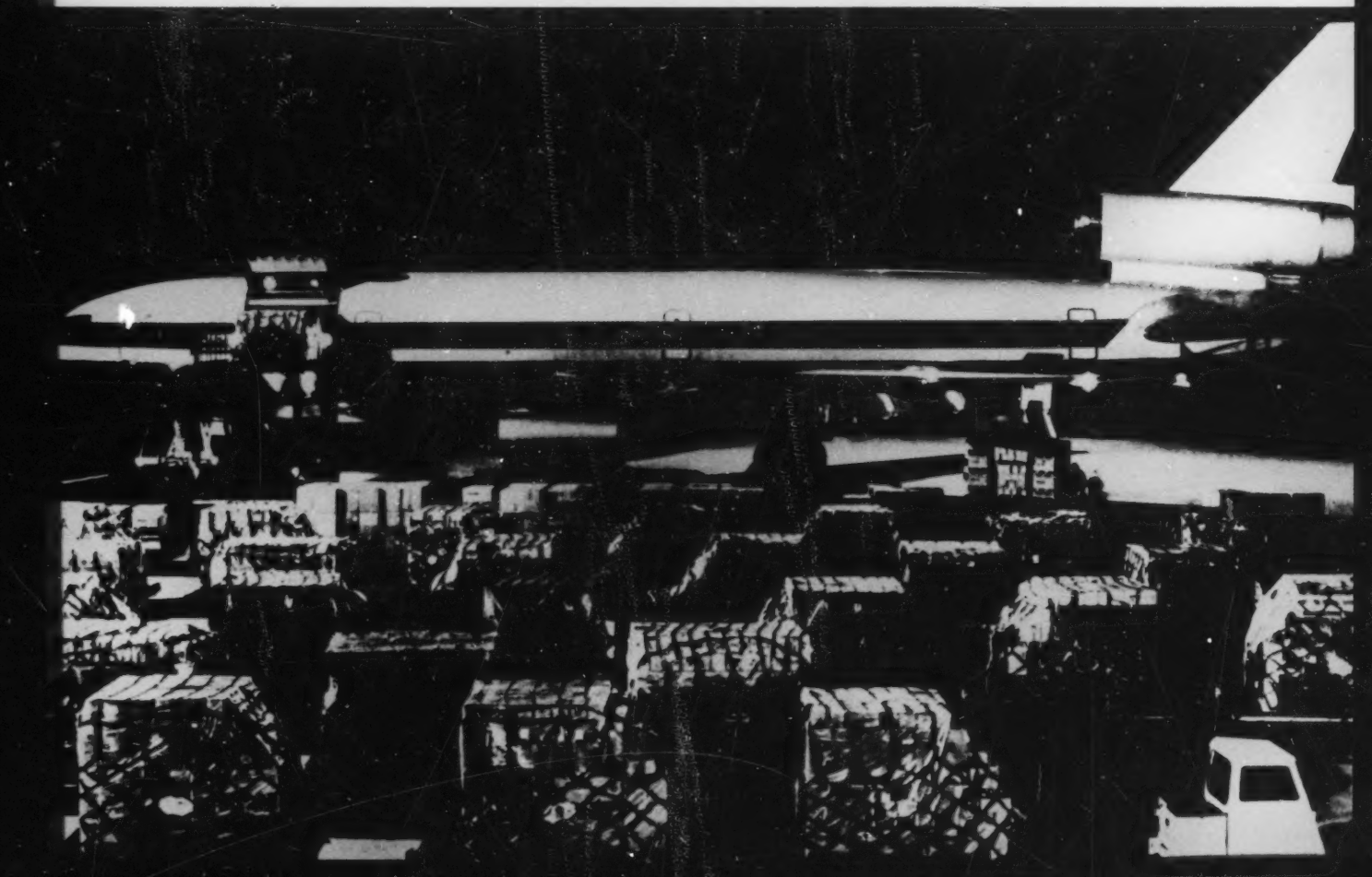
The demand for freighter services (top line) will continue to expand on a worldwide basis, as shown on the graph on the following page. By 2001, nearly 50 billion revenue tonne-kilometers of cargo will be transported on freighters. The current fleet, which also includes freighters presently on order and option, will show a modest decline of 10 percent in revenue tonne-kilometer production between

1986 and 2001. The current fleet will supply approximately one-third of the total requirement by the year 2001, with additional generic freighters needed to supplement the remaining 32-billion revenue tonne-kilometer residual. These additional generic aircraft will be a combination of new freighters and converted freighters from used passenger aircraft, with more emphasis on the latter.

FREIGHTER REVENUE TONNE-KILOMETERS SUPPLY FORECAST
(ALL SERVICES)

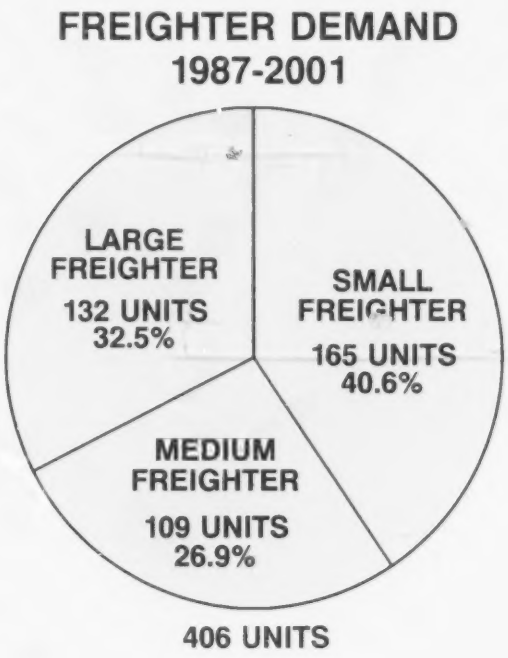


FREIGHTER FLEET



ADDITIONAL FREIGHTER REQUIREMENTS

It is forecasted that an additional 406 generic freighters will be required to satisfy the projected cargo demand over the next 15 years. The distribution below illustrates that the small freighter class will consist of nearly 41 percent of the required units, although this amounts to only 9 percent of the additional revenue tonne-kilometer production required. The large class, with almost one-third of the generic unit requirement, will account for 74 percent of the additional RTK production necessary. While a majority of the 406 freighters will be derived from used passenger aircraft conversions, a substantial number will also be newly built freighters incorporating the latest technological advancements for greater efficiency and lower operating economics.



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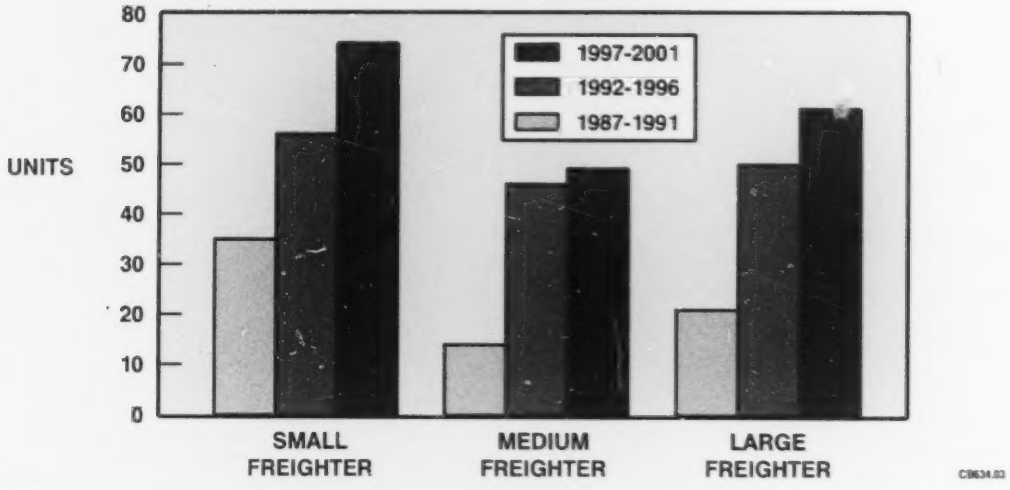
The timing for introduction of the 406 generic freighters correlates with the forecast term. This is illustrated in the upper chart on the following page. During the initial 5-year period, 17 percent of the total generic demand will be required. The next 5-year increment grows to 38 percent. The final period, 1997-2001, will produce the largest demand for generic freighter capacity, requiring 184 units or 45 percent of the total.

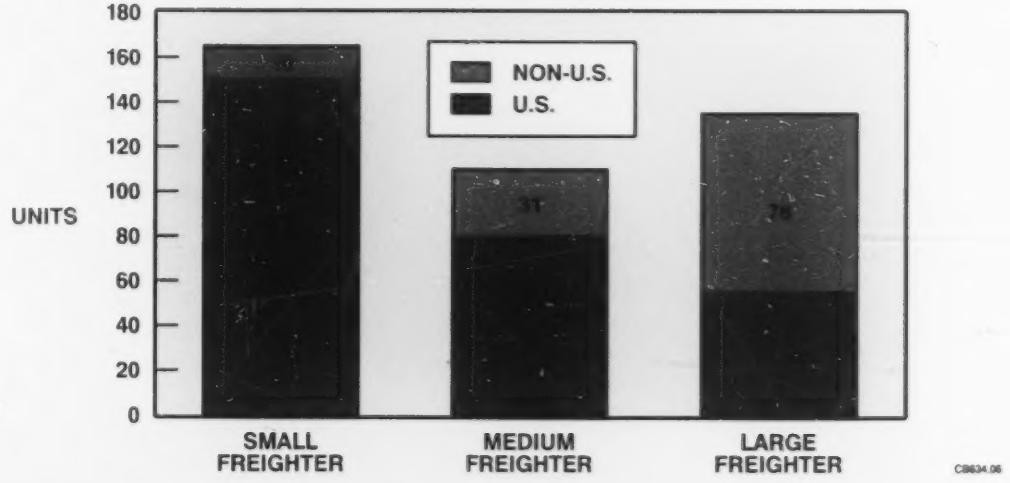
GENERIC FREIGHTER REQUIREMENTS BY FIVE-YEAR INCREMENTS



With continued proliferation of the small express package segment in the United States, the customer base for small freighters will be dominated by U.S. operators. Through 2001, U.S. carriers will account for 90 percent of the small-freighter unit demand. U.S. operators will also produce considerable demand for medium-class freighters by approaching a 72-percent share of the market. Non-U.S. carriers, however, are targeted for a majority of the large freighter class. Airlines representing this segment are almost exclusively Asian- and European-domiciled operators. Overall, U.S.-based airlines and integrated operators will provide nearly 70 percent of the worldwide unit demand for freighters.

GENERIC FREIGHTER AIRCRAFT BY DOMICILED AREA

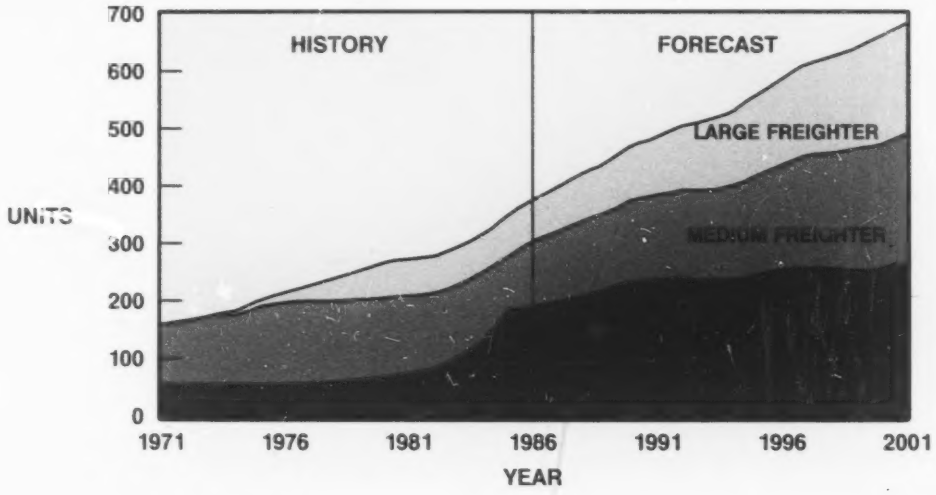
1987 - 2001



FREIGHTER FLEET COMPOSITION

During the last 15 years, the world's active freighter fleet increased over 150 percent. Changes in the industry infrastructure during the past few years caused some dramatic shifts. The rapid rise of the small express package segment with its reliance upon hub-and-spoke networks has created a sizable demand for small freighters as shown. Partially offsetting this was a reduction in medium freighters primarily due to the elimination of freighter service by a number of U.S. passenger-oriented airlines.

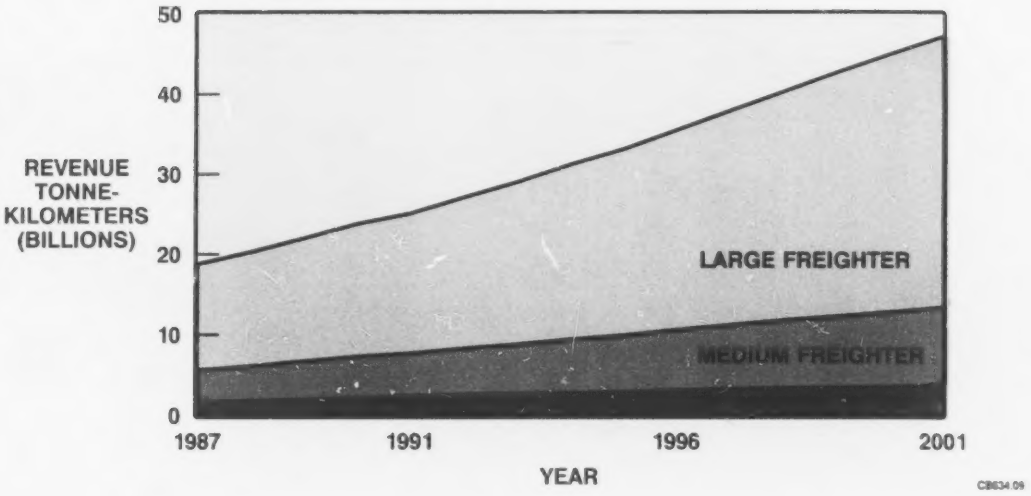
WORLDWIDE ACTIVE COMMERCIAL FREIGHTERS



The 15-year forecast indicates that the active commercial freighter fleet will expand by 86 percent to 698 units worldwide by 2001. The projected quantities include freighters currently operated minus estimated retirements, freighters currently on order/option, plus new and used generic aircraft. With its relatively small active units currently in service, the large freighter class will show the highest expansion rate by nearly tripling. As intercontinental traffic proliferates, the efficient operational economics of this freighter class will assure buoyant demand. Medium-class freighters will also demonstrate a significant unit growth by nearly doubling as small package carriers require larger capacity aircraft to supplement their hub-and-spoke operations. Small freighters will produce the least improvement by approaching only a 50-percent increase through 2001. The small freighter class will still represent the primary category in active units with 38 percent of the total at the end of this period.

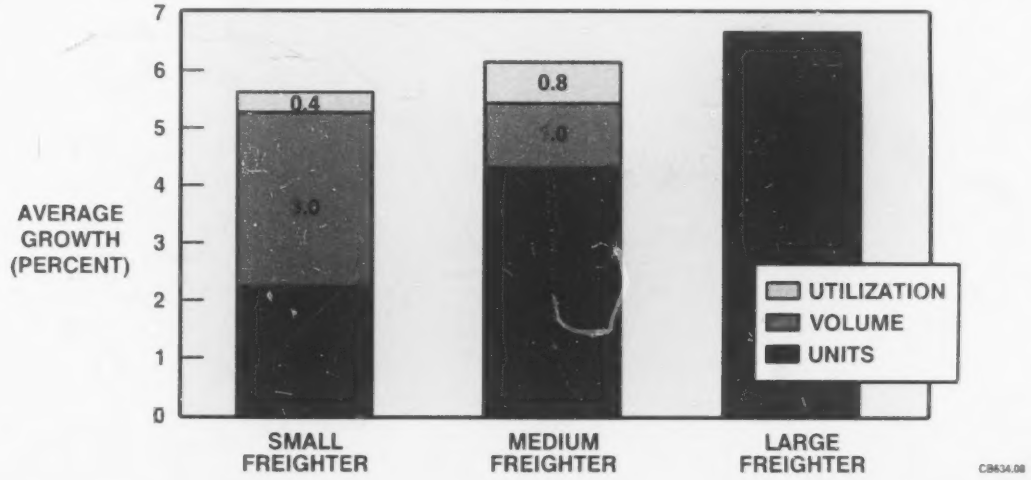
In productive revenue service, however, the dominance of the large freighter class should not be underestimated. As graphically depicted on the following page, large freighters will continue to transport over 70 percent of the world's freighter cargo in terms of revenue tonne-kilometers, followed by a distant 20 percent carried in medium freighters. The remaining 10 percent will be flown by small freighters, where higher yields can be justified by offering premium service levels such as door-to-door pickup and delivery.

FREIGHTER CARGO BY CLASS



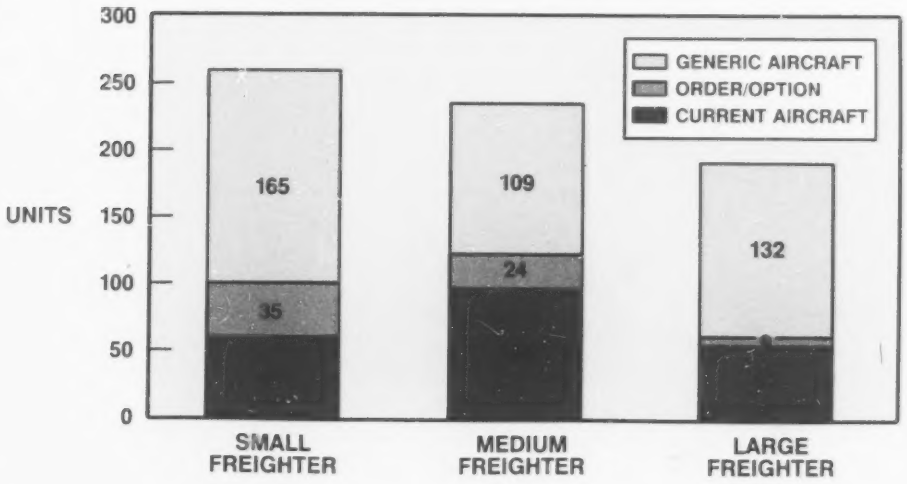
The capacity requirements in terms of available tonne-kilometer productivity are satisfied by increases in freighter units, aircraft volume, and utilization. As shown, the improvement in productivity for the three freighter classes is attained by use of these factors in varying degrees. In the small freighter class, the 5.7-percent average productivity increase is satisfied primarily by the addition of larger aircraft as the older short-fuselage segment is retired from service. Somewhat less important is the unit growth of small freighters which improves 2.3 percent annually on its large unit base. Increased utilization accounts for a minor role. In the medium class, unit growth accounts for about two-thirds of the 6.8-percent average gain, with volume and utilization sharing the remainder of the improvement. Unit growth is the sole factor in the large freighter's required development as the existing high utilization and volume cannot be further escalated.

FREIGHTER PRODUCTIVITY GAINS THROUGH YEAR 2001



The projected composition of the world's freighter fleet for 2001 is illustrated below. Current aircraft (those in service at the end of 1986) will compose 224 of the 698 freighter total, or 32 percent. Specific aircraft for which there were firm orders or options late in 1986 will account for 68 units and 10 percent of the total. And the required 406 generic freighters, which are assumed to be a combination of both new and used aircraft, will represent 58 percent of the world fleet.

FREIGHTER FLEET COMPOSITION IN YEAR 2001



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APPENDICES

APPENDIX A
DEFINITIONS

AVAILABLE SEAT-KILOMETERS – The product obtained by multiplying the number of passenger seats available on each flight stage by the flight stage distance.

CURRENT FLEET – Aircraft on hand as of December 31, 1986.

DOMICILED AREA – A geographic definition used to aggregate the total system traffic of all carriers whose home base lies within the geographic area.

FREIGHTER SERVICE – Refers to flights of aircraft carrying loads of revenue cargo (freight and mail) exclusively. All flights carrying one or more revenue passengers and flights listed in schedules as providing any passenger service are excluded.

GENERIC AIRCRAFT – A broad definition of seat size and range characteristics of current and future aircraft. The generic aircraft and typical annual capacity (ASKs in millions) are listed below. The table lists all specific aircraft members of each passenger class.

Passenger Types

SHORT RANGE-110 – Low seating capacity, varying between 60 and 135, with a range up to 2,775 kilometers.

SHORT RANGE-160 – Seating capacity from 136 to 175 with a range of 4,625 kilometers.

MEDIUM RANGE-200 – Primarily a wide-body class with seating capacity from 176 to 225 and a range of 4,625 kilometers.

LONG RANGE-200 – Primarily a wide-body class with seating capacity from 176 to 225 and a range of 6,475 to 11,000 kilometers.

MEDIUM RANGE-270 – Wide-body class with seating from 226 to 310 with a range up to 6,475 kilometers.

LONG RANGE-270 – A high-capacity wide-body class offering 226-310 seats with a range of 6,475 to 13,000 kilometers.

MEDIUM RANGE-400 – Exclusively wide-body class with seating capacity from 311 to 470 and a range up to 8,325 kilometers.

LONG RANGE-400 – High-capacity wide-body class with seating capacity from 311 to 470 and a range of 6,475 to 13,000 kilometers.

MEDIUM RANGE-600 – Stretched, high-capacity wide-body class with seating capacity from 471 to 600 and a range up to 8,325 kilometers.

LONG RANGE-600 – High-capacity wide-body class with seating capacity from 471 to 600 and a range up to 13,000 kilometers.

Cargo Types

SMALL FREIGHTER – A cargo aircraft with lift capability of 36 metric tonnes (40 English tons) or less. It includes the following types of aircraft: 757, 727-100/200, MD-80, and proposed cargo versions of the new 150-seat aircraft.

APPENDIX A
DEFINITIONS

MEDIUM FREIGHTER – A cargo aircraft with lift capability between 36 metric tonnes (40 tons) and 77 metric tonnes (85 tons). It includes the DC-10, the DC-8-70, and the proposed A300, A310, and 767 class aircraft.

LARGE FREIGHTER – A cargo aircraft with lift capability of 77 metric tonnes (85 tons) and above. It includes the 747 and the MD-11 class aircraft.

LOWER HOLD/COMBI RTKs – Freight carried below the main deck on a passenger flight or freight carried on the main deck and in the lower hold in "combi" operations.

NONSCHEDULED SERVICE (Revenue) – Charter flights and special flights performed for remuneration on an irregular basis.

PRODUCTIVITY – Measured in terms of available seat-kilometers for passenger aircraft and available tonne-kilometers for cargo aircraft.

RETAINED (USED) AIRCRAFT – An aircraft that is sold or leased by its operating carrier to another carrier within the study group.

PERMANENTLY RETIRED – An aircraft that is either sold or leased to a carrier outside of the study group or is assumed to be scrapped or grounded.

REVENUE PASSENGER KILOMETERS – Obtained by multiplying the number of revenue passengers carried on each flight by the flight distance.

REVENUE PASSENGER LOAD FACTOR – Revenue passenger-kilometers expressed as a percentage of available seat-kilometers.

REVENUE TONNE-KILOMETERS – Obtained by multiplying the number of revenue metric tonnes carried on each flight by the flight distance.

SCHEDULED SERVICE (Revenue) – Scheduled flights which are open to the public and are made according to a published timetable, or so regularly or frequently as to constitute a recognizable systematic series, and extra flights occasioned by overflow traffic from the scheduled flights.

SPECIFIC AIRCRAFT – Existing and new types of aircraft for which orders have been contracted with a manufacturer.

APPENDIX A
DEFINITIONS

PASSENGER AIRCRAFT BY GENERIC CLASS

SHORT RANGE-110

BAC 1-11-200
BAC 1-11-300
BAC 1-11-400
BAC 1-11-475
BAC 1-11-500
BAe 146-100
BAe 146-200
BAe 146-300
CARAVELLE 3
CARAVELLE 6N
CARAVELLE 6R
CARAVELLE 10B
CARAVELLE 10R
CARAVELLE 11R
CARAVELLE 12
DC-9-10
DC-9-10MC
DC-9-10RC
DC-9-20
DC-9-30
DC-9-30CF
DC-9-30RC
DC-9-40
DC-9-50
F28-1000
F28-2000
F28-3000
F28-4000
F28-6000
F100
MD-87
TRIDENT 1C
TRIDENT 1E
TRIDENT 2E
TU-104
TU-134
727-100
727-100C
727-100QC
737-100
737-200
737-200C
737-200QC
737-300
737-500

SHORT RANGE-160

A320-100
A320-200
MD-81
MD-82
MD-83
MD-88
MERCURE
TRIDENT 3B
727-200
737-400

MEDIUM RANGE-200

CONCORDE
CV-880
CV-990A
DC-8-50
DC-8-50CF
DC-8-61
DC-8-61CF
DC-8-62
DC-8-62F
DC-8-63
DC-8-63CF
DC-8-63PF
DC-8-71
DC-8-71CF
DC-8-73
DC-8-73CF
IL-62
TU-154
707-120B
707-138B
707-320
707-320B
707-320C
707-420
720
720B
757-200
767-200

LONG RANGE-200

A310-200
A310-300
DC-8-63
DC-8-63CF
DC-8-63PF
DC-8-73
DC-8-73CF
767-200ER

MEDIUM RANGE-270

A300B2-100
A300B2-300
A300B4-100
A300B4-200
A300B600
DC-10-10
DC-10-10CF
DC-10-15
L-1011-1
L-1011-100
L-1011-200
767-300

LONG RANGE-270

A300B600R
A340-200
DC-10-30
DC-10-30CF
DC-10-30ER
DC-10-40
IL-86
L-1011-500
MD-11ER
747SP
747-200CSCD
747-200FSCD
747-200SCD
767-300ER

MEDIUM RANGE-400

747-100SR
747-300SR

LONG RANGE-400

A340-300
MD-11
747-100
747-200
747-200C
747-300
747-300C
747-400

APPENDIX B
TRAFFIC DETAIL

WORLD PASSENGER TRAFFIC
HISTORY AND FORECAST, ALL SERVICES
(RPKs AND ASKs IN BILLIONS)

	Total					U.S. Carriers					Non-U.S. Carriers				
Year	RPKs	Annual Growth Rate (RPKs)	ASKs	Annual Growth Rate (ASKs)	Load Factor	RPKs	Annual Growth Rate (RPKs)	ASKs	Annual Growth Rate (ASKs)	Load Factor	RPKs	Annual Growth Rate (RPKs)	ASKs	Annual Growth Rate (ASKs)	Load Factor
1971	442.4		844.4		52.4	240.2		475.7		50.5	202.2		368.7		54.8
1972	508.4	14.9	911.7	8.0	55.8	263.9	9.9	484.4	1.8	54.5	244.5	20.9	427.3	15.9	57.2
1973	580.5	14.2	1020.8	12.0	56.9	280.5	6.3	523.1	8.0	53.6	300.0	22.7	497.7	16.5	60.3
1974	617.8	6.4	1052.1	3.1	58.7	280.0	−0.2	499.0	−4.6	56.1	337.8	12.6	553.1	11.1	61.1
1975	655.9	6.2	1134.3	7.8	57.8	278.9	−0.4	507.9	1.8	54.9	377.0	11.6	626.4	13.3	60.2
1976	719.5	9.7	1222.3	7.8	58.9	308.7	10.7	544.4	7.2	56.7	410.8	9.0	677.9	8.2	60.6
1977	786.9	9.4	1302.7	6.6	60.4	331.6	7.4	581.1	6.7	57.1	455.3	10.8	721.6	6.4	63.1
1978	893.8	13.6	1400.5	7.5	63.8	381.3	15.0	613.1	5.5	62.2	512.5	12.6	787.4	9.1	65.1
1979	1003.1	12.2	1542.0	10.1	65.1	432.0	13.3	682.1	11.3	63.3	571.1	11.4	859.9	9.2	66.4
1980	1013.6	1.0	1631.1	5.8	62.1	419.2	−3.0	706.3	3.5	59.4	594.4	4.1	924.8	7.5	64.3
1981	1032.3	1.8	1653.9	1.4	62.4	408.6	−2.5	693.9	−1.8	58.9	623.7	4.9	960.0	3.8	65.0
1982	1069.7	3.6	1709.3	3.3	62.6	429.1	5.0	722.5	4.1	59.4	640.6	2.7	986.8	2.8	64.9
1983	1128.0	5.5	1776.1	3.9	63.5	474.8	10.7	773.8	7.1	61.4	653.2	2.0	1002.3	1.6	65.2
1984	1208.8	7.2	1895.8	6.7	63.8	513.2	8.1	857.0	10.8	59.9	695.6	6.5	1038.8	3.6	67.0
1985	1298.4	7.4	2003.6	5.7	64.8	564.9	10.1	910.2	6.2	62.1	733.5	5.4	1093.4	5.3	67.1
1986	1369.5	5.5	2162.6	7.9	63.3	609.5	7.9	1002.0	10.1	60.8	760.0	3.6	1160.6	6.1	65.5
1987	1442.4	5.3	2285.2	5.7	63.1	640.6	5.1	1054.1	5.2	60.8	801.8	5.5	1231.1	6.1	65.1
1988	1557.3	8.0	2413.1	5.6	64.5	693.8	8.3	1113.1	5.6	62.3	863.5	7.7	1300.0	5.6	66.4
1989	1671.9	7.4	2563.8	6.2	65.2	743.0	7.1	1178.8	5.9	63.0	928.9	7.6	1385.0	6.5	67.1
1990	1786.8	6.9	2735.7	6.7	65.3	789.1	6.2	1249.5	6.0	63.2	997.7	7.4	1486.2	7.3	67.1
1991	1875.0	4.9	2909.6	6.4	64.4	830.1	5.2	1333.3	6.7	62.3	1044.9	4.7	1576.3	6.1	66.3
1992	2036.1	8.6	3121.8	7.3	65.2	899.9	8.4	1426.6	7.0	63.1	1136.2	8.7	1695.2	7.5	67.0
1993	2175.9	6.9	3309.6	6.0	65.7	954.8	6.1	1502.2	5.3	63.6	1221.1	7.5	1807.4	6.6	67.6
1994	2319.9	6.6	3473.1	4.9	66.8	1006.3	5.4	1556.3	3.6	64.7	1313.6	7.6	1916.8	6.1	68.5
1995	2433.1	4.9	3627.0	4.4	67.1	1048.6	4.2	1613.9	3.7	65.0	1384.5	5.4	2013.1	5.0	68.8
1996	2611.1	7.3	3828.0	5.5	68.2	1115.7	6.4	1681.6	4.2	66.3	1495.4	8.0	2146.4	6.6	69.7
1997	2766.0	5.9	4025.3	5.2	68.7	1168.1	4.7	1747.2	3.9	66.9	1597.9	6.9	2278.1	6.1	70.1
1998	2930.9	6.0	4251.9	5.6	68.9	1223.0	4.7	1817.1	4.0	67.3	1707.9	6.9	2434.8	6.9	70.1
1999	3107.6	6.0	4523.2	6.4	68.7	1281.7	4.8	1926.1	6.0	66.5	1825.9	6.9	2597.1	6.7	70.3
2000	3294.0	6.0	4741.2	4.8	69.5	1343.3	4.8	1983.9	3.0	67.7	1950.7	6.8	2757.3	6.2	70.7
2001	3494.5	6.1	4992.6	5.3	70.0	1407.7	4.8	2049.4	3.3	68.7	2086.8	7.0	2943.2	6.7	70.9

APPENDIX B
TRAFFIC DETAIL

WORLD CARGO TRAFFIC
HISTORY AND FORECAST, ALL SERVICES
(RTKs IN BILLIONS)

	Total				U.S. Carriers				Non-U.S. Carriers			
Year	FRTR RTKs	Annual Growth Rate (RTKs)	Total RTKs	Annual Growth Rate (RTKs)	FRTR RTKs	Annual Growth Rate (RTKs)	Total RTKs	Annual Growth Rate (RTKs)	FRTR RTKs	Annual Growth Rate (RTKs)	Total RTKs	Annual Growth Rate (RTKs)
1971	7.7		15.6		5.6		9.1		2.1		6.4	
1972	8.3	7.8	17.4	11.7	5.7	2.9	9.7	5.7	2.5	21.1	7.7	20.1
1973	8.8	5.9	19.4	11.5	5.4	−5.7	9.7	0.6	3.3	32.3	9.7	25.0
1974	9.3	5.3	21.0	7.9	5.2	−3.8	9.7	−0.4	4.0	20.2	11.3	16.4
1975	9.6	3.1	21.4	1.8	4.8	−7.2	9.2	−4.5	4.7	16.5	12.1	7.2
1976	10.8	13.2	24.2	13.2	5.0	3.7	9.8	6.1	5.8	23.0	14.4	18.7
1977	12.3	13.9	27.4	12.9	5.7	13.0	11.0	12.4	6.6	14.7	16.3	13.2
1978	13.6	10.2	29.5	8.0	6.2	9.5	11.4	3.0	7.4	10.7	18.1	11.3
1979	14.2	4.5	31.5	6.6	6.3	1.8	11.7	2.6	7.9	6.7	19.8	9.2
1980	14.3	0.7	32.8	4.1	6.2	−1.3	11.6	−0.8	8.1	2.5	21.2	7.0
1981	14.4	0.4	34.7	5.7	6.1	−2.5	11.6	0.6	8.3	2.7	23.0	8.5
1982	14.2	−1.1	35.1	1.2	6.0	−1.5	11.5	−1.1	8.2	−0.7	23.6	2.3
1983	15.0	5.6	38.4	9.4	6.7	11.7	12.9	12.2	8.3	1.2	25.5	8.1
1984	17.1	14.6	43.4	13.2	7.8	16.4	14.6	13.2	9.3	12.0	28.8	12.9
1985	17.3	1.4	44.0	1.3	7.7	−0.7	14.2	−2.5	9.6	3.2	29.8	3.5
1986	18.6	8.0	47.4	7.8	8.2	6.5	15.1	6.3	10.4	8.3	32.3	8.4
1987	19.7	6.1	50.2	5.9	8.6	5.4	15.8	4.6	11.1	6.7	34.4	6.5
1988	21.4	8.6	54.3	8.2	9.3	8.1	16.9	7.5	12.1	9.0	37.4	8.7
1989	23.2	8.3	58.6	7.9	10.0	8.4	18.1	7.1	13.2	9.1	40.5	8.3
1990	25.0	7.7	63.0	7.5	10.8	7.3	19.3	6.2	14.2	7.6	43.7	7.9
1991	26.3	5.2	66.1	5.0	11.3	5.1	20.1	4.5	15.0	5.6	46.0	5.3
1992	28.5	8.3	71.6	8.3	12.2	7.7	21.5	7.0	16.3	8.7	50.1	8.9
1993	30.5	7.2	76.8	7.3	13.0	6.7	22.9	6.1	17.5	7.4	53.9	7.6
1994	32.7	7.1	82.4	7.2	13.9	6.4	24.2	6.0	18.8	7.4	58.2	8.0
1995	34.6	5.8	87.1	5.7	14.6	5.5	25.4	5.0	20.0	6.4	61.7	6.0
1996	37.2	7.3	93.4	7.2	15.7	7.4	27.2	7.0	21.5	7.5	66.2	7.3
1997	39.6	6.7	99.6	6.7	16.6	6.1	28.8	6.0	23.0	7.0	70.8	6.9
1998	42.1	6.3	105.7	6.2	17.6	5.8	30.5	5.6	24.5	6.5	75.2	6.2
1999	44.6	5.8	111.8	5.7	18.6	5.3	32.0	5.2	26.0	6.1	79.8	6.1
2000	46.9	5.3	117.6	5.2	19.5	5.0	33.6	4.8	27.4	5.4	84.0	5.3
2001	49.2	4.8	123.1	4.7	20.4	4.5	35.1	4.4	28.8	5.1	88.0	4.8

APPENDIX C
TOTAL WORLD
PASSENGER JET AIRCRAFT REQUIREMENT BY GENERIC CLASS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
SHORT RANGE-110																	
Perm Retired			(77)	(62)	(81)	(119)	(142)	(168)	(133)	(149)	(68)	(48)	(29)	(49)	(43)	(36)	(1,204)
Orders		138	106	44	15												303
Generic Aircraft			9	29	42	87	161	160	107	119	120	59	66	90	70	82	1,201
End-of-year Total	2,615	2,753	2,791	2,802	2,778	2,746	2,765	2,757	2,731	2,701	2,753	2,764	2,801	2,842	2,869	2,915	
SHORT RANGE-160																	
Perm Retired			(14)	(30)	(50)	(52)	(98)	(79)	(79)	(59)	(47)	(28)	(55)	(35)	(29)	(10)	(665)
Orders		77	105	89	58	15	4										348
Generic Aircraft			12	68	96	150	198	169	142	113	131	109	86	124	114	129	1,641
End-of-year Total	1,531	1,608	1,711	1,838	1,942	2,055	2,159	2,249	2,312	2,366	2,450	2,531	2,562	2,651	2,736	2,855	
MED/LONG RANGE-200																	
Perm Retired			(19)	(13)	(18)	(19)	(22)	(51)	(38)	(15)	(21)	(18)	(14)	(6)	(10)	(6)	(270)
Orders		74	48	22	20	11											175
Generic Aircraft			30	43	44	37	66	92	81	77	69	77	83	71	73	62	905
End-of-year Total	705	779	838	890	936	965	1,009	1,050	1,093	1,155	1,203	1,262	1,331	1,396	1,459	1,515	
MEDIUM RANGE-270																	
Perm Retired			(10)	(2)		(8)	(9)	(17)	(34)	(23)	(19)	(21)	(11)	(16)	(20)	(6)	(196)
Orders		21	5	3	3	2	3										37
Generic Aircraft			21	35	47	25	54	38	45	54	51	48	64	73	63	76	694
End-of-year Total	578	599	615	651	701	720	768	789	800	831	863	890	943	1,000	1,043	1,113	
LONG RANGE-270																	
Perm Retired								(5)	(4)	(3)	(7)	(5)	(7)	(11)	(11)	(3)	(56)
Orders		7	5	1													13
Generic Aircraft			9	28	6	8	34	41	38	25	23	26	31	30	35	32	366
End-of-year Total	326	333	347	376	382	390	424	460	494	516	532	553	577	596	620	649	
MEDIUM RANGE-400/600																	
Perm Retired								(6)	(3)	(5)	(5)						(19)
Orders		1															1
Generic Aircraft			3	3	5	4	7	13	22	14	27	21	21	30	20	21	211
End-of-year Total	28	29	32	35	40	44	51	58	77	86	108	129	150	180	200	221	
LONG RANGE-400																	
Perm Retired								(12)	(13)	(14)	(17)	(17)	(23)	(14)	(4)	(4)	(118)
Orders		17	5	28	34	12	6	2									104
Generic Aircraft			6	7	7	18	32	52	42	27	48	43	52	58	57	67	516
End-of-year Total	401	418	429	464	505	535	573	615	644	657	688	714	743	787	840	903	
LONG RANGE-600																	
Perm Retired																	
Orders																	0
Generic Aircraft									10	18	19	22	26	25	16	17	153
End-of-year Total									10	28	47	69	95	120	136	153	0
TOTAL																	
Perm Retired			(120)	(107)	(149)	(198)	(271)	(338)	(304)	(268)	(184)	(137)	(139)	(131)	(117)	(65)	(2,528)
Orders		335	274	187	130	40	13	2									981
Generic Aircraft			90	213	247	329	552	565	487	447	488	405	429	501	448	486	5,687
End-of-year Total	6,184	6,519	6,763	7,056	7,284	7,455	7,749	7,978	8,161	8,340	8,644	8,912	9,202	9,572	9,903	10,324	

APPENDIX C
TOTAL U.S.
PASSENGER JET AIRCRAFT REQUIREMENT BY GENERIC CLASS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
SHORT RANGE-110																	
Perm Retired			(44)	(38)	(53)	(64)	(69)	(100)	(76)	(84)	(25)	(13)	(8)	(10)	(11)	(15)	(610)
Orders		86	70	36	6												198
Generic Aircraft			1	10	23	42	79	84	42	59	60	19	7	24	11	14	475
End-of-year Total	1,246	1,332	1,359	1,367	1,343	1,321	1,331	1,315	1,281	1,256	1,291	1,297	1,296	1,310	1,310	1,309	
SHORT RANGE-160																	
Perm Retired			(1)	(11)	(22)	(36)	(91)	(77)	(78)	(54)	(42)	(15)	(38)	(20)	(20)		(505)
Orders		56	60	31	11	5											163
Generic Aircraft			12	32	54	90	114	86	66	60	67	47	25	55	43	55	806
End-of-year Total	1,041	1,097	1,168	1,220	1,263	1,322	1,345	1,354	1,342	1,348	1,373	1,405	1,392	1,427	1,450	1,505	
MED/LONG RANGE-200																	
Perm Retired			(4)	(4)	(4)		(5)	(18)	(9)								(44)
Orders		30	16	11	11	8											76
Generic Aircraft			5	17	11	13	37	57	36	48	26	37	35	40	32	26	420
End-of-year Total	191	221	238	262	280	301	333	372	399	447	473	510	545	585	617	643	
MEDIUM RANGE-270																	
Perm Retired			(8)	(1)		(8)	(9)	(13)	(25)	(18)	(17)	(19)	(7)	(10)	(11)	(3)	(149)
Orders		4															4
Generic Aircraft			12	22	24	12	27	9	16	26	15	18	21	20	17	23	262
End-of-year Total	276	280	284	305	329	333	351	347	338	346	344	343	357	367	373	393	
LONG RANGE-270																	
Perm Retired														(5)	(4)		(9)
Orders																	0
Generic Aircraft			11	14	7	8	21	20	17	5	9	4	5	4	3	10	138
End-of-year Total	55	55	66	80	87	95	116	136	153	158	167	171	176	175	174	184	
MEDIUM RANGE-400/600																	
Perm Retired																	0
Orders																	0
Generic Aircraft						2	3	7	15	10	17	9	16	21	12	14	126
End-of-year Total						2	5	12	27	37	54	63	79	100	112	126	
LONG RANGE-400																	
Perm Retired								(5)	(7)	(8)	(7)	(9)	(13)	(8)	(1)	(2)	(60)
Orders		2	2	6	6												16
Generic Aircraft				2	3	6	8	11	10	10	15	13	12	19	13	11	133
End-of-year Total	104	106	108	116	125	131	139	145	148	150	158	162	161	172	184	193	
LONG RANGE-600																	
Perm Retired																	
Orders																	0
Generic Aircraft									2	3	4	7	8	8	5	4	41
End-of-year Total									2	5	9	16	24	32	37	41	82
TOTAL																	
Perm Retired			(57)	(54)	(79)	(108)	(174)	(213)	(195)	(164)	(91)	(56)	(66)	(53)	(47)	(20)	(1,377)
Orders		178	148	84	34	13											457
Generic Aircraft			41	97	122	173	289	274	204	221	213	154	129	191	136	157	2,401
End-of-year Total	2,913	3,091	3,223	3,350	3,427	3,505	3,620	3,681	3,690	3,747	3,869	3,967	4,030	4,168	4,257	4,394	

APPENDIX C
TOTAL WORLD
FREIGHTER JET AIRCRAFT REQUIREMENT BY GENERIC CLASS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
SMALL																	
Perm Retired					(1)	(11)	(15)	(19)	(7)		(6)	(5)	(17)	(17)	(16)	(5)	(119)
Orders		5	5	5	5	5+	10+										35
Generic Aircraft		4	6	6	11	8	11	12	9	9	15	12	14	14	16	18	165
End-of-Year Total	183	192	203	214	229	231	237	230	232	241	250	257	254	251	251	264	
MEDIUM																	
Perm Retired			(2)	(2)		(1)	(4)	(3)	(3)						(3)	(2)	(20)
Orders*		7	9	5	3												24
Generic Aircraft			1	2	7	4	9	10	9	8	10	10	9	10	10	10	109
End-of-Year Total	123	130	138	143	153	156	161	168	174	182	192	202	211	221	228	236	
LARGE																	
Perm Retired											(2)		(5)	(5)			(12)
Orders		6	1			2											9
Generic Aircraft			6	5	5	5	9	11	6	14	10	10	15	13	14	9	132
End-of-Year Total	69	75	82	87	92	99	108	119	125	139	147	157	167	175	189	198	
TOTAL																	
Perm Retired			(2)	(2)	(1)	(12)	(19)	(22)	(10)		(8)	(5)	(22)	(22)	(19)	(7)	(151)
Orders		18	15	10	8	7	10										68
Generic Aircraft		4	13	13	23	17	29	33	24	31	35	32	38	37	40	37	406
End-of-Year Total	375	397	423	444	474	486	506	517	531	562	589	616	632	647	668	698	

\+ Options

* Includes Conversions to DC-8-73CF

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